# PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

## MEETING OF OCTOBER 1, 1957

A regular meeting was held at the American Museum of Natural History and was called to order by President Treat. Fourteen members and two guests were present. Mr. Robert Bloch was appointed Secretary Protem.

Dr. Ruckes reported on the Executive Committee meeting held prior to the regular meeting. Dr. James Mullen was appointed Vice President and Mr. Peter Farb, Secretary for the duration of the terms. The Committee resolved, in effect, to constitute itself, together with the Publications Committee, an Interim Editorial Board with Mr. Soraci retaining the office of Editor, and to take the initiative in promptly restoring the Journal of the Society to full quarter publication. Mr. Boyd reported that the 1956 volume of the Journal would be out by December 1, 1957. The Committee voted that authors should no longer be required to pay the full cost of plates for articles accepted. It was voted to accept the report of the Executive Committee.

The report of the Committee on By-Laws was read by the President. Action will be taken at a later meeting.

Dr. Roy Whelden of Haskins Laboratory, Union College, Schenectady, New York, was proposed for membership by Dr. Clausen. Dr. Schneirla moved that the by-laws be suspended in order to elect Dr. Whelden at this meeting. It was so voted and he was elected unanimously. The President proposed for membership Mr. Tony Roberts and Mr. Bryan Treat.

The members of the Society reported on their summer activities. Mr. Bloch and Mr. Huberman told of their efforts to combat resistance to insecticides in pests. Trips reported on were Mrs. Hopf's to Nova Scotia, Mrs. Campbell's to Vermont, Dr. Treat's to Maine, Dr. Schneirla's to the southeast for the study of Army ants and Dr. Schmitt's to New Hampshire to collect insects for studying their neuro-muscular mechanisms.

Dr. Pohl spent three months in Europe and presented the Society with two postcards commemorating J. H. Fabre. He brought greetings to the Society from the French Entomological Society and presented a menu of the 33rd Annual Banquet of the Société d'Acclimatation et de Protection de la Nature.

In the absence of Mr. Soraci who was in Nova Scotia, Mr. Boyd reported that the gypsy moth spraying campaign was very successful and that it controlled other insects as well.

The meeting was adjourned at 9:50 P.M.

PETER FARB, *Secretary*

## MEETING OF OCTOBER 15, 1957

A regular meeting of the Society was held at the American Museum of

(*continued on page 156*)

# ACTIVITIES OF RESPIRATORY ENZYMES DURING THE METAMORPHOSIS OF THE HOUSEFLY, MUSCA DOMESTICA LINNAEUS*

BY DANIEL LUDWIG AND MARY C. BARSA
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Agrell (1949) described total dehydrogenase activity and the specific activities of malic, citric, succinic and glutamic dehydrogenases as U-shaped during the metamorphosis of the blowfly, *Calliphora erythrocephala*. However, Ludwig and Barsa (1958) found that only malic and succinic dehydrogenases and the malic enzyme have U-shaped activity curves during this period in the mealworm, *Tenebrio molitor*.

In the present investigations, a study was made of the dehydrogenase respiratory enzymes of the housefly to compare their activities with those of other insects during metamorphosis.

## MATERIAL AND METHODS

The insects used in this study were DDT-sensitive houseflies obtained from the Boyce Thompson Institute for Plant Research. The adults were kept at room temperature (approximately 25° C.) and fed diluted milk and sugar water. The eggs were laid on filter paper placed in the milk. They were removed daily and placed in the larval medium which consisted of animal pellets which had been powdered and soaked in tap water. The larvae were reared at room temperature and when they began to leave the food, they were placed on a piece of filter paper in a large petri dish. Insects, within 6 hours of puparium formation, were placed in labelled beakers and kept at 25° C. Immediately following puparium formation, they were designated as 0-day pupae, although they were probably in the prepupal stage.

The houseflies were washed in an alcohol solution, according to the procedure followed by Cotty (1956), to remove surface bacteria before homogenization. They were homogenized by means of a motor-driven glass homogenizer for 1 minute in the

* This work was supported in part by the Medical Research and Developmen Board, Office of the Surgeon General, Department of the Army, under Contract No. DA–49–007–MD–444.

proper buffer. In all cases the buffers were adjusted to a pH of 7.4. The activities of succinic, malic, glucose, glutamic, alpha-glycerophosphate, lactic and isocitric dehydrogenases and the malic enzyme were determined by the Thunberg technique as given by Umbreit, Burris and Stauffer (1945, p. 126). Details of substrates, coenzymes, buffers and salts used in each enzymatic determination, as well as the procedure followed in preparing the Thunberg tubes are given by Ludwig and Barsa (1958). Samples of the same homogenate were used in the experimental tube and in the control. The rates of enzyme activity (1/time in minutes for 90 per cent decoloration of the methylene blue) were measured at 30° C. Activity values were obtained by subtracting the rate of the control from that of the experimental tube. Throughout all experiments, a minimum of 10 determinations were made.

## OBSERVATIONS

Changes in the activities of the dehydrogenase enzymes during the metamorphosis of the housefly are shown in Table 1 and

TABLE 1.

Dehydrogenase Activity During the Metamorphosis of the Housefly. Activity is Expressed as 1/Time in Minutes for 90 Per Cent Decoloration of Methylene Blue. Readings Were Made at 30°C. (GPD is Alpha-glycerophosphate Dehydrogenase).

| Stages | Dehydrogenase | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Alcohol | Glucose | GPD I | GPD II | Isocitric | Lactic (total) | Malic | Malic enzyme | Succinic |
| Larva | 0.041 | 0.004 | 0.047 | ..... | 0.402 | 0.048 | 0.333 | 0.097 | 0.008 |
| Puparium just formed | 0.042 | ..... | 0.013 | ..... | 0.282 | 0.012 | 0.337 | 0.047 | 0.006 |
| Pupa, 1-day | 0.037 | 0.014 | 0.011 | ..... | 0.255 | 0.018 | 0.312 | 0.061 | 0.004 |
| Pupa, 2-day | 0.024 | 0.013 | 0.004 | ..... | 0.220 | 0.006 | 0.204 | 0.056 | 0.002 |
| Pupa, 3-day | 0.027 | 0.013 | 0.005 | ..... | 0.197 | 0.005 | 0.179 | 0.063 | 0.004 |
| Pupa, 4-day | 0.025 | 0.013 | 0.003 | 0.004 | 0.194 | 0.002 | 0.262 | 0.060 | 0.005 |
| Pupa, 5-day | 0.024 | 0.013 | 0.015 | 0.009 | 0.158 | 0.004 | 0.461 | 0.058 | 0.013 |
| Adult, just emerged | 0.043 | 0.003 | 0.043 | 0.030 | 0.180 | 0.005 | 0.897 | 0.086 | 0.028 |

Figure 1. The activities of succinic, malic, total alpha-glycerophosphate and alcohol dehydrogenases and of the malic enzyme

followed U-shaped curves. Alpha-glycerophosphate II (enzyme not requiring DPN) was absent until the 4-day pupa and its activity greatly increased in the adult. The activity of lactic dehydrogenase was high (0.048) in the larva but it decreased rapidly and very little activity was observed in the latter part

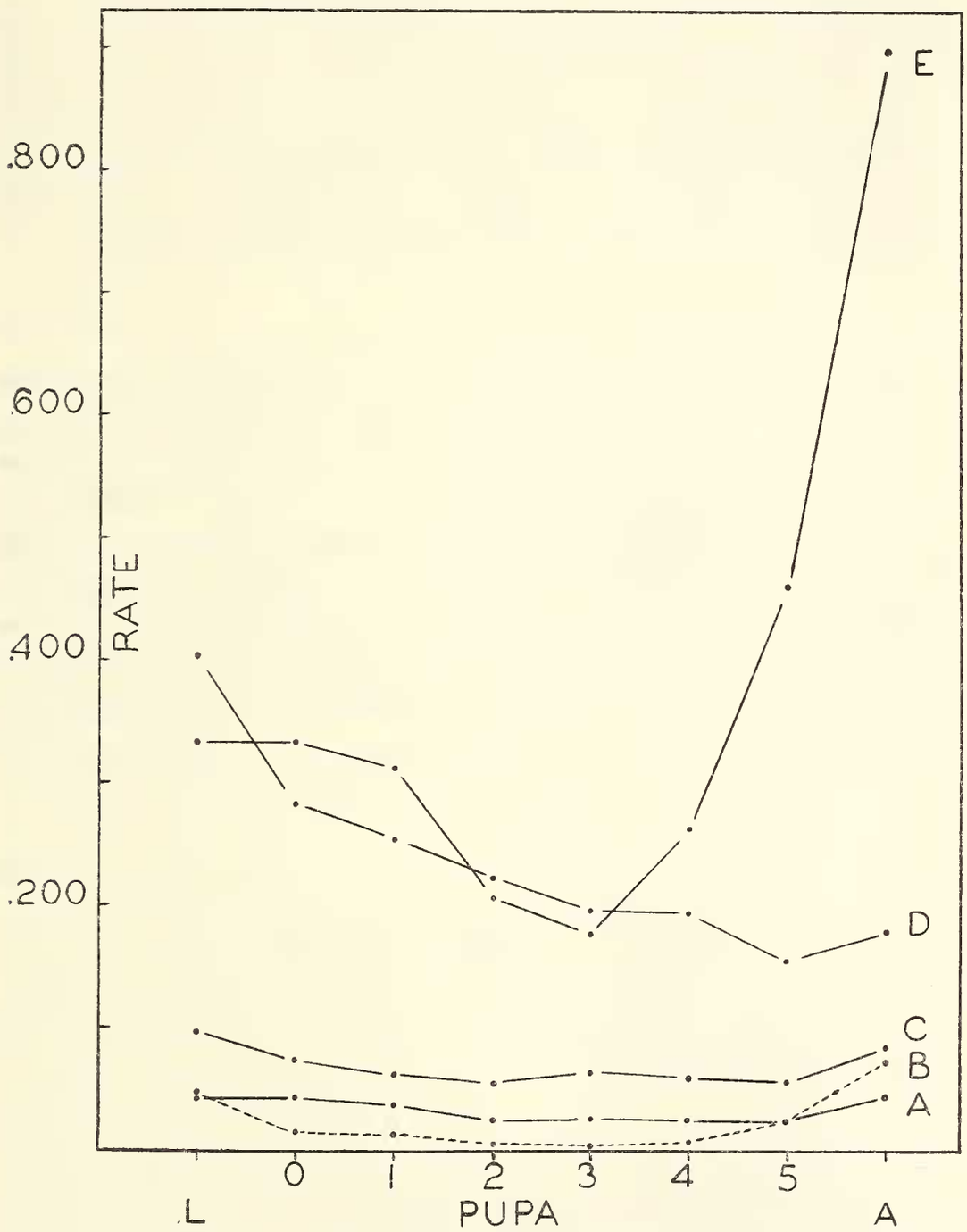


FIGURE 1. Changes in the activity of dehydrogenase enzymes during the metamorphosis of the housefly. Rate is expressed at 1/time in minutes for 90 per cent decoloration of methylene blue. Graph A, alcohol dehydrogenase; Graph B, alpha-glycerophosphate dehydrogenase; Graph C, malic enzyme; Graph D, isocitric dehydrogenase; Graph E, malic dehydrogenase. L, larva; A, newly emerged adult.

of the pupal stage or in the adult. A lactic dehydrogenase not requiring DPN was observed only in the larva. Its activity amounted to about one-fourth the total lactic dehydrogenase activity of this stage. A very low glucose dehydrogenase activity was observed during the prepupal and adult stages. However, this enzyme showed a constant value of 0.013 throughout the pupal stage. A low activity of glutamic dehydrogenase was obtained in the larva but it disappeared early in the pupal stage. Isocitric dehydrogenase activity was high at the beginning, but decreased steadily during the remainder of metamorphosis. The activities of malic and isocitric dehydrogenases were much greater than those of any of the other enzymes studied.

## DISCUSSION

The activities of succinic, isocitric and malic dehydrogenases and the malic enzyme of the housefly are similar to those reported for these enzymes during the metamorphosis of the mealworm, *Tenebrio molitor,* by Ludwig and Barsa (1958). However, the malic dehydrogenase of the adult housefly is more active than that reported in the previous work for the adult mealworm. The activity curves for alcohol and alpha-glycerophosphate I (requiring DPN) dehydrogenases are U-shaped during the metamorphosis of the housefly but remained constant in the mealworm. Alpha-glycerophosphate II dehydrogenase (not requiring DPN) was not found until near the end of metamorphosis in the housefly but was present throughout this process in the mealworm. Glutamic dehydrogenase was found in the larva of the housefly but this enzyme does not appear until near the end of metamorphosis in the mealworm. In both species the activity of lactic dehydrogenase is very low throughout metamorphosis. These results differ from those of Agrell (1949) for the blowfly, *Calliphora erythrocephala,* in that the activity curves for glutamic and isocitric dehydrogenases of the housefly are not U-shaped. The activity curve for succinic dehydrogenase has been found to be U-shaped during the metamorphosis of the following species: *Drosophila melanogaster,* Wolsky (1941); *Calliphora erythrocephala,* Agrell (1949); *Bombyx mori,* Ito (1955); *Popillia japonica,* Ludwig and Barsa (1955); *Tenebrio molitor,* Ludwig and Barsa (1958); *Ephestia kühniella,* Diamantis (1959); and *Musca*

*domestica,* (the present work). Since the activity of this enzyme is very low, it could be a determining factor in the U-shaped respiratory curve characteristic of insect metamorphosis.

SUMMARY

A study was made of the activities of the dehydrogenase enzymes during the metamorphosis of the housefly using the Thunberg technique.

The activities of succinic, malic, total alpha-glycerophosphate and alcohol dehydrogenases and of the malic enzyme follow U-shaped curves during metamorphosis. Alpha-glycerophosphate II (not requiring DPN) was absent until the 4-day pupa and its activity greatly increased in the adult. Lactic and glutamic dehydrogenases were present in the larva but disappeared early in the pupal stage. Isocitric dehydrogenase activity was high at the beginning but decreased steadily during the remainder of metamorphosis. There was a low activity of glucose dehydrogenase in both the larval and adult stages. However, this enzyme showed a constant higher value throughout the pupal stage.

The activity curve for succinic dehydrogenase has been found to be U-shaped during metamorphosis in all insects studied. Since the activity of this enzyme is very low, it could be a determining factor in the U-shaped respiratory curve characteristic of insect metamorphosis.

## Literature Cited

AGRELL, I. P. S. 1949. Localization of some hydrogen-activating enzymes in insects during metamorphosis. Nature. **164**: 1039–1040.

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ITO T. 1950. The physiology in the metamorphosis of *Bombyx mori* II. Succinoxidase system in the pupal stage. Annot. Zool. Japan. **28**: 1–7.

LUDWIG, D. AND M. C. BARSA. 1955. The activity of succinic dehydrogenase during diapause and metamorphosis of the Japanese beetle (*Popillia japonica* Newman). Jour. N. Y. Ent. Soc. **63**: 161–165.

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UMBREIT, W. W., R. H. BURRIS AND J. F. STAUFFER. 1945. Manometric techniques and related methods for the study of tissue metabolism. Minneapolis: Burgess Publishing Co.

WOLSKY, A. 1941. Quantitative changes in the substrate-dehydrogenase system of *Drosophila melanogaster* pupae during metamorphosis. Science. 94: 48.

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Natural History. The meeting was called to order by President Treat. Thirteen members and two guests were present.

The President reported on the publication schedule of the Journal, as discussed at the meeting of the Executive Committee. The first issue of 1957 will be out the middle of January, combined issues two and three by April, and the last issue by the middle of June.

Two new members—Master Tony Roberts, aged 14, and Master Bryan Treat, age 9—were unanimously elected to membership.

The President was about to bring the proposed changes in the By-laws to a vote when Dr. Forbes raised the point that they must first be advertised to the membership. It was agreed that a copy of the changes would be sent to each member previous to the meeting of November 19th. At that time they will be voted upon.

Dr. T. C. Schneirla of the American Museum of Natural History spoke on "Field Studies of Army Ants in Southeastern United States." This report on his summer's extension of the Arizona work with Doryline ants was illustrated by a series of kodachromes. Dr. Schneirla first reviewed his previous reports to the Society on the nomadic and statary phases of activity in these ants, and his work with the genus *Neiramyrmex* at the Museum's Southwestern Research Station in Arizona.

His summer's work was devoted to studying *Neiramyrmex nigrescens* in the Southeast, a common species extending to the Atlantic Coast. The study was made at the Bankhead National Forest in Alabama and the Sumter National Forest in South Carolina.

In Arizona Dr. Schneirla had always been able to physically follow the colony under observation. Not so in the Southeast. The "Tallulah" colony, at the end of the statary curve with a large oncoming pupal brood, was located in a stump and a cordon thrown around the bivouac. After five nights the colony was lost. It was again located and promptly lost. The colony had passed from statary to nomadic phase because of the stimulation of the maturing brood.

Next studied was the "Mound" colony and, like "Tallulah," was difficult to follow. However a method of tracery was used without keeping actual physical continuity with the colony. It was found that in the Southeast, colonies were better observed during the statary phase since at this time they selected stumps, while in Arizona they became subterranean. As with the Arizona observations of *nigrescens*, it was seen that the colony was unstable during the first few days of the 18-day statary phase, and that the queen became physogastric early and late in this phase.

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# ESTIMATION OF ANT COLONY SIZE BY THE LINCOLN INDEX METHOD[1]

By Robert M. Chew

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Apparently the only method used in the past for estimating the size of ant colonies has been to excavate the colony completely and count all individuals unearthed. The uncertainty and difficulty of this method is well illustrated by the history of *Myrmecocystus melliger* Forel. Wheeler (1908) felt that this species forms small colonies of hardly more than 300–500 individuals with chambers that do not descend more than a foot or so into the soil. He thought that he had completely excavated such colonies. That this may not have been true is obvious from the report of Creighton and Crandall (1954) on the excavation of one colony near Tucson. At the beginning of excavation, the vertical extent of this colony was apparently going to be limited by a rock-like layer of caliche, eighteen inches below the soil surface. However, careful following of a single small lead descending vertically through the caliche led to the discovery of new chambers at a depth of thirty inches. After penetration of five to six feet of caliche, the excavation was completed at a depth of sixteen feet, where the queen's chamber was found. Over 1500 repletes and hundreds of normal workers were found in the many chambers of this colony. Previously this species was thought not to have repletes. Tevis (1958) followed colonies of *Veromessor pergandei* (Mayr) as deeply as eleven feet without completely excavating any colony.

While certain biological information, such as the occurrence of repletes in *M. melliger,* can be obtained only by laborious digging, the present author has found that the number of foraging workers can be estimated much more simply, by the use of the Lincoln Index method, or the mark-release-recapture method. This method has been widely used in censusing populations of different vertebrate animals.

As used by the author, this method is as follows: (1) 100–400 worker ants are collected from a colony entrance with an aspirator; (2) these individuals are etherized in several batches and each ant is marked on the dorsum with a spot of Testors colored

[1] Contribution from Southwestern Research Station, American Museum of Natural History, Portal, Arizonia. Work carried out under the support of National Science Foundation Grant G-5570.

dope; (3) the marked ants are counted and then released at the colony entrance after they have revived (the few ants whose legs have become bound up by dried dope are removed); (4) a second sample of ants is collected 24 hours later, and the marked and unmarked individuals counted; (5) the total number of foraging workers in the colony is calculated by the formula:

$$\text{total no. workers} = \frac{(\text{No. ants in 2nd sample}) \times (\text{total no. marked})}{\text{Number of marked ants recaptured}}.$$

The use of this method is based on several assumptions: (a) any individual in the colony is susceptible of being captured and marked; (b) the marked individuals mix thoroughly with unmarked before resampling; (c) marking is permanent during the length of the sampling period, and does not adversely influence the behavior or survival of marked individuals. Considering these assumptions with regard to ants:

(a) As far as is known, all normal worker ants that are beyond the callow stage participate in foraging and carrying materials out of the nest. The situation in bees, where younger workers limit themselves to duties inside the nest, while only older workers forage outside, is not known to occur in ants (W. S. Creighton, personal communication). Therefore, any individual worker is susceptible of being captured outside the nest and marked or counted.

Certain special types of workers do not normally leave the nest, and these would not be captured or enter into the estimation of colony size. Repletes, such as found in some species of the genus *Myrmecocystus,* do not leave the nest, but full repletes are not found in any other North American genus. The major workers of many species of *Pheidole* do not forage, and the majors of *Cryptocerus* and *Camponotus* probably do not forage. These exceptions are few and they do not limit the application of the Lincoln Index method to most species of ants.

(b) The thoroughness with which marked and unmarked workers mix within the colony in 24 hours is not yet certain. When there are several openings to a colony, several feet apart, marked individuals released at one entrance are not necessarily captured in equal ratios at all entrances 24 hours later. This indicates incomplete mixing.

(c) Spots of Testors colored dope are not permanent markings. The dope flakes off in a matter of one to several days.

Counting of marked individuals in the recapture sample is best done under magnification, in order to detect those ants that have only a small fleck of dope still adhering to a hair or bristle. When a colony is resampled at 24-hour intervals, the calculated colony size shows a gradual increase. This indicates inversely the rate at which marked individuals are losing their identification. If such data are plotted, as in Figure 1, the curve can be interpolated to zero time, i.e. no loss of markings, for a possibly more accurate estimation of colony size. The loss of markings in the first 24 hours for *Pogonomyrmex occidentalis* is within the range of variability of different samples taken at 24 hours after release. It should be possible to find a more adherent marking material, which would allow a sampling interval of more than 24 hours and thus more thorough mixing in of marked individuals.

There is no evidence that this method of marking results in the death of marked individuals.

Table 1 gives preliminary data on colony size of three species of ants in Cochise County, Arizona. As expected, there is a

TABLE 1.

NUMBER OF FORAGING WORKERS IN COLONIES OF THREE SPECIES OF ANTS IN COCHISE CO., ARIZONA.

| Colony # | Date | Foraging Workers | Mound Size |
|---|---|---|---|
| *Novomessor cockerelli* (E. Andre) | | | |
| A13 | Oct. 3 | 236 | 52 cu. in.* |
| A8 | Oct. 13 | 570 | 254 cu. in. |
| A4 | Oct. 13 | 648 | 221 cu. in. |
| A1a | Oct. 13 | 570 | — |
| *Myrmecocystus mimicus* Wheeler | | | |
| A25 | Oct. 22 | 650 | 39 sq. in.** |
| A26 | Oct. 23 | 1280 | 29 sq. in. |
| *Pogonomyrmex occidentalis* (Cresson) | | | |
| P1 | Sept. 21 | 1320 | 302 cu. in.* |
| P2 | Sept. 21 | 435 | 74 cu. in. |
| P3 | Oct. 8 | 2100 | 1470 cu. in. |

* mound size figured as volume of cone; ** basal area of crater-like mound.

*N. cockerelli* and *M. mimicus* colonies were located in a creosote bush community, 4500′ elevation, 6 mi. north of Portal, Arizona; *P. occidentalis* colonies were in pine-oak woodland, 5400′ Southwestern Research Station, Portal.

range of sizes for a particular species. A relationship between colony size and surface mound size is suggested.

The marking of ants with colored spots is also highly useful in determining whether adjacent mounds and entrances are parts of a single colony or separate colonies. Tèvis (1958) found that *Veromessor pergandei* colonies change their entrance hole about 10 times a year. One entrance is abandoned and another opened up. In the course of a year these different entrances of the same colony cover an area approximately 50 feet in diameter. Similar shifts of activity, and also simultaneous use of several entrances, have been observed by the

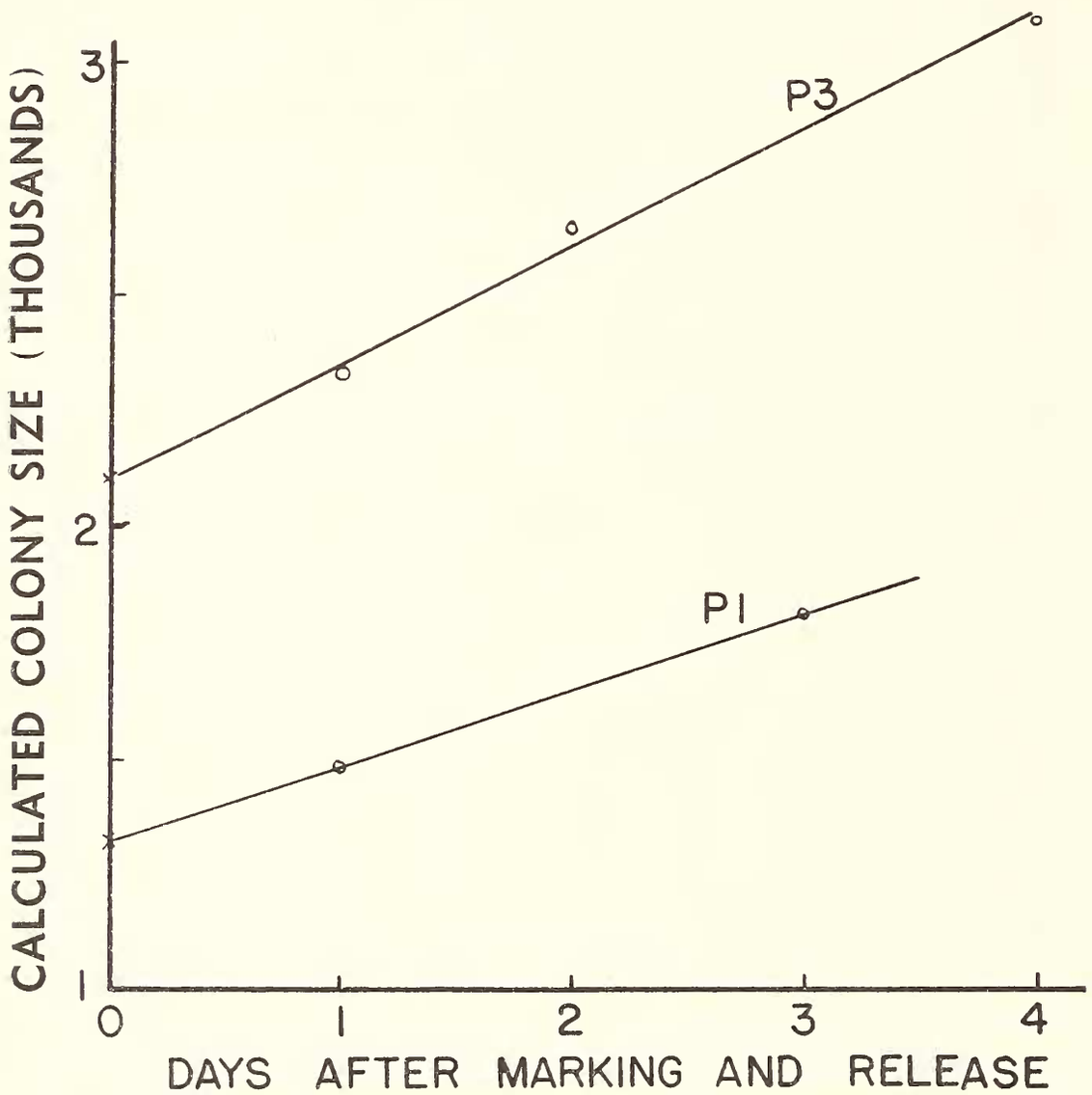


Figure 1. Estimation of number of foraging workers in colony of *Pogonomyrmex occidentalis*. True colony size is taken as value of line extrapolated to zero time, i.e. before any marking on ants had flaked off.

present author for *Novomessor cockerelli.* Colony A4 in Table 1 had three openings in a triangular arrangement 6 to 10 feet apart. Two of these openings had relatively high mounds, while the third was marked only by a circle of fine angular gravel. In the initial test to determine whether these openings were all part of a single colony, 100 individuals were marked green at entrance A, 118 were marked blue at entrance B, and none were marked at entrance C. Resampling at all entrances 24 hours later showed: A—115 unmarked, 45 green, 11 blue; B—62 unmarked, 49 blue, 2 green; C—48 unmarked, 4 blue, 3 green. While the three entrances are indicated as part of one colony, there was an obvious tendency for recapture of a particular color marking predominantly at the entrance where it was used.

The present paper is presented in the hope of stimulating further testing, development and use of the Lincoln Index method in ant work. Data easily obtained on size of colonies can be the bases for different kinds of ecological studies. The author is using the method to follow seasonal changes in colony sizes and as a basis for the calculation of the energy requirements of colonies, i.e. (colony size) × (measured metabolism of individual ants) = total energy requirement for colony. The method can also be used to follow growth of colonies from year to year. The mark-release-recapture method has the great advantage that it can be used repeatedly on the same colony, while the digging method destroys a colony at first use.

## Literature Cited

CREIGHTON, W. S. AND R. H. CRANDALL. 1954. New data on the habits of *Myrmecocystus melliger* Forel. The Biol. Rev., C.C.N.Y. **16** (1): 2–6.

TEVIS, L. 1958. Interrelations between the harvester ant *Veromessor pergandei* (Mayr) and some desert ephemerals. Ecology **39**(4): 695–704.

WHEELER, W. M. 1908. Honey ants with a revision of the American Myrmecocysti. Bull. Amer. Mus. Nat. Hist. **24**: 345–397.

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These observations emerged from the summer's work: *N. nigrescens* operates on a nomadic-statary pattern in the Southeast throughout its summer cycle, much as in the Arizona studies. The statary phase lasts about 18 days both in Arizona and the Southeast. Differences noted were that the Southeast colonies were not so numerous and they worked more in the leaf-mold and animal burrows, often following subterranean tree roots, than in Arizona.

The discussion of Dr. Schneirla's studies continued until 9:55 P.M., when the meeting was adjourned.

PETER FARB, *Secretary*

## MEETING OF NOVEMBER 19, 1957

President Treat called to order a regular meeting of the Society in Room 419 of the American Museum of Natural History at 8:10 P.M. Eighteen members and six guests were present.

Mr. Bloch read a letter informing the Society of the death of Mr. Isaiah Cooper, formerly Curator of the Staten Island Museum and a member for many years of the Society. The Society unanimously passed a resolution of sympathy and the Secretary was directed to send this on behalf of the Society to his daughter.

Dr. Treat reported on an informal meeting held in Mr. Heineman's home on November 5th. He announced donations made to the Society by Messrs. Heineman, Schwarz and Dos Passos, and the Inwood Foundation. These additional funds now make possible the new meeting room, more attractive notices sent before each meeting, and the ability to obtain out-of-town speakers.

In the absence of Vice President Mullen, Dr. Forbes announced the programs for the rest of the 1957–8 year.

Mr. Bloch proposed that consideration be given to an annual dinner. The President stated that it would be taken under advisement by the Executive Committee.

The Amendments to the By-laws were passed as follows: (Deletions are enclosed in parentheses; additions are in italics).

### Article II

All candidates for membership must be proposed by an active member of the Society at a regular *or annual* meeting. . . .

### Article III

2. . . . The Executive Committee shall be composed of the President (Chairman), and four active members, all entitled to vote. The Editor, *Vice-President,* Associate Editor, Secretary, and Treasurer shall also be members of the Executive Committee but not entitled to vote. . . .

3. Standing Committees of the Society to be appointed by the President, shall consist of an Auditing Committee, composed of three active members; *a Program Committee,* and a Field Committee, *each* composed of two active members.

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# AN ANNOTATED LIST OF THE LYCAENIDAE (LEPIDOPTERA, RHOPALOCERA) OF THE WESTERN HEMISPHERE

By William Phillips Comstock and Edgar Irving Huntington

[Continued from LXVII (2), p. 95]

*bethulia* Hewitson, W. C., *Thecla*

Type Locality: Amazon (Pará).

Location of Type: British Museum (Natural History).

Original Description: 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 128, vol. 2, pl. 51, figs. 278, 279 ♂ (London).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (August), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 61 (London). (Makes *bethulia* a synonym of *empusa* Hewitson.)

Note: This should be checked.

*bethune-bakeri* Comstock, W. P. and E. I. Huntington, *Hemiargus ammon*

Type Locality: Miami, Florida, January 26, 1932.

Location of Type: American Museum of Natural History.

Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 97, pl. 1, fig. 25 ♂ (New York, N. Y.).

*bianca* Möschler, H. B., *Thecla*

Type Locality: Interior of Surinam.

Location of Type:

Original Description: 1883, Verh. zool.-bot. Ges., vol. 32, p. 310, pl. 17, fig. 5 (Wien).

Additional Reference: Draudt, Max, 1921 (January), The Macrolepidoptera of the World, vol. 5, p. 823 (Stuttgart). (Said: "P. 766, line 9 from below; cancel *bianca* Mschlr.")

Note: Referring to p. 766, this might mean that Draudt considered *bianca* to be the female of *malvania* Hewitson. See *ostrinus* Druce.

Synonyms: *ostrinus* Druce.

*biblia* Hewitson, W. C., *Thecla*

Type Locality: Amazon.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 12 (London).

Additional Reference: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 150, vol. 2, pl. 59, figs. 384, 385 ♂ (London). Amazon (Tapajos).

*bicolor* Philippi, R. A., *Lycaena?*
Type Locality: Santiago, Chile.
Location of Type:
Original Description: 1860, Linnaea Entomologica Zeitschrift, vol. 14, p. 269 (Berlin).
Additional Reference: Hewitson, W. C., 1877, Illus. of Diurnal Lepidoptera, vol. 1, p. 208, vol. 2, pl. 83, figs. 697 ♂, 695, 696 ♀ (London).

*bilix* Draudt, Max, *Thecla*
Type Locality: Río Aguaca Valley, Colombia.
Location of Type: Fassl Collection. Now in Naturhistorisches Museum, Basle.
Original Description: 1919 (December), The Macrolepidoptera of the World, vol. 5, p. 759, pl. 153-g ♂ (Stuttgart).

*bimaculata* Möschler, H. B., *Thecla*
Type Locality: Inner Surinam (2 ♂ ♂, 1 ♀).
Location of Type:

Original Description: 1876, Verh. zool.-bot. Ges., vol. 26, p. 299, pl. 3, fig. 3 (Wien).
Addition Reference: Draudt, Max, 1919, The Macrolepidoptera of the World, vol. 5, 747 (Stuttgart). (Considers *bimaculata* a synonym of *nobilis* Herrich-Schäffer.)

*binangula* Schaus, William, *Thecla*
Type Locality: Peru.
Location of Type: United States National Museum, no. 5941 ♂.
Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 415 (Washington, D. C.).

*biston* Möschler, H. B., *Thecla*
Type Locality: Inner Surinam (1 ♂, 1 ♀).
Location of Type:
Original Description: 1876, Verh. zool.-bot. Ges., vol. 26, p. 302, pl. 3, fig. 5 (Wien.).

*bitias* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1777, Papillons exotiques des trois parties du monde, vol. 2, p. 12, pl. 104, fig. E (Amsterdam).
Additional Reference: Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 779 (Stuttgart). (Says *bitias* is probably a synonym of *syncellus* Cramer.)

*blackmorei* Barnes, William and J. H. McDunnough, *Plebeius icarioides* var. nov.
Type Locality: Goldstream, Vancouver Island, B. C.
Location of Type: United States National Museum, Barnes Collection.

(Paratype in American Museum of Natural History.)

Original Description: 1919 (April), Can. Ent., vol. 51, p. 92 (London, Ontario).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 455 (Los Angeles, Calif.). (Places *blackmorei* as a subspecies of *icarioides* Boisduval.)

*blenina* Hewitson, W. C., *Thecla*

Type Locality: Mexico.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 12 (London).

Additional References: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 127, vol. 2, pl. 50, figs. 256, 257 ♂ (London). Godman, F. D. and O. Salvin, 1887 (June), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 48, (London). (Makes *blenina* a synonym of *xami* Reakirt.)

*boeonides* Capronnier, J. B., *Thecla* Nomen nudum

Type Locality: Copa Cabana, Brazil.

Location of Type:

Original Description: 1874, Ann. Soc. Ent. Belgique, vol. 17, p. 15 (Bruxelles).

*bogotana* Draudt, Max, *Hemiargus hanno* form

Type Locality: Bogotá, Colombia.

Location of Type:

Original Description: 1921 (January), The Macrolepidoptera of the World, vol. 5, p. 819 (Stuttgart).

*boharti* Gunder, Jean D., *Plebeius saepiolus* tr. f.

Type Locality: Yosemite National Park, California, July 24, 1931.

Location of Type: American Museum of Natural History.

Original Description: 1932 (January), Pan-Pacific Entomologist, vol. 8, p. 127 (San Francisco, Calif.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 453 (Los Angeles, Calif.). (Places *boharti* as an aberration of *saepiolus* Boisduval.)

*bolima* Schaus, William, *Thecla*

Type Locality: Castro, Parana, Brazil.

Location of Type: United States National Museum, no. 5942 ♂.

Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 416 (Washington, D. C.).

*borealis* Ureta R., *Leptotes trigemmatus*

Type Locality: Azapa, Chile; December 24, 1938.

Location of Type: Museo Nacional de Historia Natural, Santiago, Chile.

Original Description: 1949, Boletín del Museo Nacional de Historia Natural, vol. 24, p. 112, pl. 2, fig. 11 (Santiago, Chile).

*boreas* Felder, Cajetan and Rudolf Felder, *Pseudolycaena*
Type Locality: New Granada, Bogotá.
Location of Type:
Original Description: 1864–1876, Reise der Osterreichischen Fregatte "Novara" um die Erde, vol. 2, p. 244, pl. 31, fig. 12 (Wien).

*bornoi* Comstock, W. P. and E. I. Huntington, *Hemiargus*
Type Locality: Port Beudet, Haiti, March 3–4, 1922.
Location of Type: American Museum of Natural History.
Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 102, pl. 1, figs. 18, 19 ♀ (New York, N. Y.).

*borus* Boisduval, Jean A., *Thecla*
Type Locality: California, May.
Location of Type: United States National Museum?
Original Description: 1869, Ann. Soc. Ent. Belgique, vol. 12, p. 43 (Bruxelles).
Additional References: Kirby, W. F., 1871, A Synonymic Catalogue of Diurnal Lepidoptera, p. 396 (London). (Makes *borus* a synonym of *californica* Edwards.) Oberthür, Charles, 1913 (October), Etudes de Lepidopterologie Comparee, fasc. 9, pt. 1, p. 42, pl. 238, fig. 1953 (Rennes).

*bosora* Hewitson, W. C., *Thecla*
Type Locality: Curaray, Ecuador.
Location of Type: British Museum (Natural History).
Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 66 (London).
Additional References: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 166, vol. 2, pl. 65, figs. 459, 460 ♂ (London). Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 616 (London). (Said: "has a large discal spot on the upperside of the fore wing, and a narrow white line closing the cell of the same wing below which is not mentioned by Hewitson and is not shown in his figure.") Allied to *thespia* Hewitson and *photismos* Druce.

*bourkei* Kaye, W. J., *Thecla*
Type Locality: Jamaica, B. W. I. (1 ♀).
Location of Type: Bourke Collection, Oxford Museum. (Bernard Heineman says type was not in Oxford Museum according to Prof. Valary on May 15, 1953.)
Original Description: "1924" (1925), Trans. Ent. Soc. London, p. 416 (London).
Additional References: Kaye, W. J., 1931, Trans. Ent. Soc. London, vol. 79, p. 536, pl. 39, fig. 8 ♂ (London). Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 61 (New York, N. Y.).

*bouvieri* Lathy, Percy I., *Thecla*
Type Locality: Ecuador.

Location of Type: Fournier Collection (Paris).

Original Description: 1936, Livre jubilaire de M. Eugène-Louis Bouvier, p. 231, pl. 8, fig. 13 (Paris).

*boyeri* Comstock, W. P. and E. I. Huntington, *Thecla angelia*

Type Locality: Pétionville, Haiti, May.

Location of Type: American Museum of Natural History.

Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 70 (New York, N. Y.).

Additional Reference: Comstock, W. P., 1944 (October), Scientific Survey of Puerto Rico and the Virgin Islands, vol. 12, pt. 4, 487, pl. 9, fig. 4 ♂ (New York, N. Y.),

*boyi* Röber, J., *Thecla*

Type Locality: Uypiranga, Río Negro.

Location of Type:

Original Description: 1931, Intern. Ent. Zeit., vol. 24, p. 391 (Guben).

Note: Near *gabriela* Cramer.

*brasiliensis* Draudt, Max, *Eumaeus minyas* form

Type Locality: Amazon.

Location of Type:

Original Description: 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 745 (Stuttgart).

Additional Reference: Lathy, Percy I., 1926, Ann. Mag. Nat. Hist., 9th Series, vol. 17, p. 39 (London). (Believes *brasiliensis* to be a synonym of *toxana* Boisduval.)

*brasiliensis* Talbot, George, *Thecla*

Type Locality: Urucum, 15 miles south of Corumba, Matto Grosso, Brazil.

Location of Type: Hill Museum (Brit. Mus.).

Original Description: 1928, Bull. Hill Museum, vol. 2, pt. 3, p. 218 (London).

*brehmei* Barnes, William and F. H. Benjamin, *Mitoura gryneus* race *castalis* form

Type Locality: Shovel Mountain, Texas.

Location of Type: Barnes Collection, United States National Museum.

Original Description: 1923, Contributions to the natural history of the Lepidoptera of North America, vol. 5, p. 64 (Decatur, Illinois).

*brescia* Hewitson, W. C., *Thecla*

Type Locality: Mexico.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 13 (London).

Additional References: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 119, vol. 2, pl. 50, figs. 260, 261 ♂ (London). Godman, F. D. and O. Salvin, 1887 (June), Biologia Centrali-Americana, In-

secta, Lepidoptera-Rhopalocera, vol. 2, p. 43, vol. 3, pl. 53, figs. 8, 9 ♂, 10 ♀ (London).

Synonyms: *thoana* Hewitson.

*brocela* Dyar, Harrison, G., *Thecla*

Type Locality: Cotahuasi, Peru, 9,000 ft., October, 1911.

Location of Type: United States National Museum, no. 15,622.

Original Description: 1913, Proc. U. S. Natl. Mus., vol. 45, p. 637. (Washington, D. C.).

*browni* dos Passos, Cyril F., *Lycaena nivalis*

Type Locality: Snowslide Canyon, 8 miles from Montpeliar, Idaho, July 10, 1929.

Location of Type: American Museum of Natural History.

Original Description: 1938 (March), Can. Ent., vol. 70, no. 3, p. 45, pl. 2, figs. 1, 2, 3, 4 (Orillia, Canada).

*brunnea* Tutt, J. W., *Celastrina argiolus* ab.

Type Locality: Brooklyn, New York.

Location of Type:

Original Description: 1908, Nat. Hist. Brit. Lepid., vol. 9, p. 413 (London).

Additional References: Edwards, W. H., 1884, The Butterflies of North America, vol. 2, Lycaena, p. 10, pl. 2, fig. 25 (Boston, Mass.). McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 475 (Los Angeles, Calif.). (Places *brunnea* as an aberration of *pseudargiolus* Boisduval and LeConte.)

*bryanti* Leussler, R. A., *Plebejus aquilo* race

Type Locality: Black Mountain, 30 miles Southwest of Aklavik, Northwest Territory, 68 deg. No. Lat.

Location of Type: American Museum of Natural History.

Original Description: 1935 (April), Bull. Brooklyn Ent. Soc., vol. 30, p. 58 (Brooklyn, N. Y.).

*bubastus* Cramer, Pierre, *Papilio*

Type Locality: "Cap de Bonne Esperance."

Location of Type:

Original Description: 1780, Papillons exotiques des trois parties du monde, vol. 4, p. 84, pl. 332, figs. G, H (Amsterdam).

Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 78 (New York, N. Y.).

Synonyms: *salona* Hewitson.

Subspecies: *ponce* Comstock and Huntington.

*buccina* Druce, Hamilton H., *Thecla*

Type Locality: Chapada, Tapajos, Brazil.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 585, pl. 34, fig. 4 ♂ (London).

*buchholzi* dos Passos, Cyril F., *Plebeius icarioides*
Type Locality: White Mountains, Arizona, 8500 ft., June 25, 1937.
Location of Type: American Museum of Natural History.
Original Description: 1938 (March), Can. Ent., vol. 70, no. 3, p. 47, pl. 2, figs. 13, 14, 15, 16 (Orillia, Canada).

*buchholzi* Freeman, H. A., *Strymon*
Type Locality: Pharr, Texas, November 24, 1946 and October 14, 1944.
Location of Type: H. A. Freeman Collection.
Original Description: 1950 (January), Field and Laboratory, vol. 18, no. 1, p. 12 (Southern Methodist, Univ., Dallas, Texas).

*bulvus*—, *Heodes hypophlaeas* ab. Misspelling of *fulvus*
Type Locality:
Location of Type:
Original Description: 1929. Zool. Record, vol. 65, Insecta, p. 240.

*bunnirae* Dyar, Harrison G., *Thecla*
Type Locality: Sierra de Guerrero, Mexico, February, 1913.
Location of Type: United States National Museum, no. 21, 199.
Original Description: 1919, Proc. U. S. Natl. Mus., vol. 54, p. 336 (Washington, D. C.).
Additional Reference: Schaus, William, 1920, Ent. News, vol. 31, p. 176 (Philadelphia, Pa.). (Makes *bunnirae* Dyar a synonym of *canus* Druce.)

*buphonia* Hewitson, W. C., *Thecla*
Type Locality: Amazon.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 25 (London).
Additional Reference: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 148, vol. 2, pl. 58, fig. 374 ♂ (London). Amazon (Obydos).

*burdi* Kaye, W. J., *Thecla*
Type Locality: St. Vincent, B. W. I.
Location of Type:
Original Description: 1923, Entomologist, vol. 56, p. 277 (London).
Additional Reference: Huntington, E. I., 1944 (December), Jour. New York Ent. Soc., vol. 52, p. 328 (Lancaster, Pa.). ("*Thecla burdi* Kaye a Synonym").
Note: Synonym of *Thecla angerona* Godman and Salvin.

*burdicki* Henne, C., *Leptotes marina* form
Type Locality: Lennox, Los Angeles County, California, October 10, 1932.
Location of Type: Burdick Collection, Lennox, Los Angeles County, California. (Paratype United States National Museum.)
Original Description: 1935 (April), Ent. News, vol. 46, no. 4, p. 100, fig. 1 (Philadelphia, Pa.).

*burica* Dyar, Harrison, G., *Thecla*
Type Locality: Trinidad River, Panama.

Location of Type: United States National Museum, no. 15,757.

Original Description: 1915, Proc. U. S. Natl. Mus., vol. 47, p. 150 (Washington, D. C.).

*buris* Druce, Hamilton H., *Thecla*

Type Locality: Ega, Amazonas, Brazil.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 590, pl. 34, fig. 18 ♂ (London).

*busa* Godman, F. D. and O. Salvin, *Thecla*

Type Locality: Chontales, Nicaragua.

Location of Type: British Museum (Natural History).

Original Description: 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 26, vol. 3, pl. 51, figs. 1, 2 ♂ (London).

*cabiria* Hewitson, W. C., *Thecla*

Type Locality: Brazil.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 195, vol. 2, pl. 77, figs. 623, 624 ♀ (London).

Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 607 (London). (Makes *cabiria* a synonym of *hesperitis* Butler and Druce.)

Note: If *lugubris* Möschler is recognized as the southern race of *hesperitis* Butler and Druce, *cabiria* Hewitson would be a synonym of *lugubris*.

*cadmus* Felder, Cajetan and Rudolf Felder, *Pseudolycaena*

Type Locality: Venezuela.

Original Description: 1864–1867, Reise der Osterreichischen Fregatte "Novara" um die Erde, vol. 2, p. 247, pl. 31, fig. 5 (Wien).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 27, vol. 3, pl. 51, figs. 8, 9 ♂, 10 ♀ (London).

*caeca* Reiff, William, *Heodes*

Type Locality: Blue Hills, Massachusetts, May 26, 1912.

Location of Type: Reiff Collection.

Original Description: 1913 (July), Ent. News, vol. 24, p. 306, pl. 10, figs. 3, 4 (Philadelphia, Pa.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 26, no. 435 (Los Angeles, Calif.). (Places *caeca* as a synonym of *Lycaena hypophlaeas* ab. *obliterata* Scudder.)

*caesaries* Druce, Hamilton H., *Thecla*

Type Locality: Bartica, British Guiana.

Location of Type: Druce Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 617, pl. 36, fig. 19 ♂ (London).

*caespes* Druce, Hamilton H., *Thecla*
Type Locality: La Paz, Bolivia.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 614, pl. 36, fig. 18 ♀ (London).

*caeus* Godman, F. D. and O. Salvin, *Theclopsis*
Type Locality: Calobre, Panamá.
Location of Type: British Museum (Natural History).
Original Description: 1887 (October), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 101, vol. 3, pl. 58, figs. 24, 25 ♂ (London).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 631 (London).

*cajona* Reakirt, Tyron, *Lycaena*
Type Locality: California.
Location of Type: Strecker Collection (1 ♂, 1 ♀).
Original Description: 1866 (June), Proc. Ent. Soc. Phila., vol. 6, p. 147 (Philadelphia, Pa.).
Additional Reference: Strecker, Herman, 1900 (March), Lepidoptera, Rhopaloceres and Heteroceres, Supplement no. 3, p. 20 (Reading, Pa.). (Makes *cajona* a synonym of *anna* Edwards.)

*calanus* Auctorum (= *falacer* Godart)
Type Locality:
Location of Type:
Original Description:

*calanus* Hübner, Jacob, *Rusticus armatus*
Type Locality:
Location of Type:
Original Description: 1809, Sammlung exotischer Schmettlinge, vol. 1, pl. (100) (Augsburg).
Note: Boisduval and LeConte (1833, Histoire Générale et iconographie des Lépidoptères et des chenilles de l'Amérique Septentrionale, p. 92) make *calanus* Hübner a synonym of *falacer* Godart, which was a mistake.)
Synonyms: *wittfeldi* Edwards.

*calatia* Hewitson, W. C., *Thecla*
Type Locality: Nicaragua (Chontales).
Location of Type: British Museum (Natural History).
Original Description: 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 148, vol. 2, pl. 58, fig. 375 ♀ (London).

*calcas* McDunnough, James H., *plebeius* (not Behr). See *calchas* Behr
Type Locality:
Location of Type:
Original Description: 1938, Check list, pt. 1, p. 27, no. 458 (Los Angeles, Calif.). (Misspelled *calchas* as *calcas*.)

*calchas* Behr, Herman, *Lycaena*
Type Locality: Mono Lake, California.
Location of Type:
Original Description: 1867 (January), Proc. Calif. Acad. Nat. Sci., vol. 3, pt. 1, p. 281 (San Francisco, Calif.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 458 (Los Angeles, Calif.). (Places *calchas* (as *calcas*) as a synonym of *shasta* Edwards.)
Synonyms: *calcas* McDunnough.

*calchinia* Hewitson, W. C., *Thecla*
Type Locality: Amazons.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 21 (London).
Additional Reference: Hewitson, W. C., 1973 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 145, vol. 2, pl. 57, figs. 359, 360 ♂ (London). Amazon (Ega).

*calena* Hewitson, W. C., *Thecla*
Type Locality: Nicaragua (Chontales).
Location of Type: British Museum (Natural History).
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 187, vol. 2, pl. 74, figs. 581, 582 ♂ (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 77 (London). (Make *calena* a synonym of *denarius* Butler and Druce.)

*calesia* Hewitson, W. C., *Thecla*
Type Locality: Curaray, Ecuador.
Location of Type: British Museum (Natural History).
Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 67 (London).
Additional Reference: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 163, vol. 2, pl. 64, figs. 445, 446 (London).

*californica* Edwards, William H., *Thecla*
Type Locality: California.
Location of Type:
Original Description: 1862 (April), Proc. Acad. Nat. Sci. Phila., p. 223 (Philadelphia, Pa.).
Synonyms: *borus* Boisduval, *cygnus* Edwards, *cycnus* Scudder.

*callanga* Dyar, Harrison G., *Lycaena* (Staudinger MS ?)
Type Locality: San Miguel, Peru, 6,000 ft., July 24, 1911; Urubamba, Peru, 9,500 ft., July 15, 1901.
Location of Type: United States National Museum.
Original Description: 1913, Proc. U. S. Natl. Mus., vol. 45, p. 638 (Washington, D. C.).

*callao* Druce, Hamilton H., *Thecla*
Type Locality: Callao, Peru.
Location of Type: British Museum (Natural History).

Original Description: 1907, Proc. Zool. Soc. London, p. 611, pl. 36, fig. 11 ♂ (London).

Additional Reference: Druce, H. H., 1909 (September), Trans. Ent. Soc. London, p. 437 (London). (Makes *callao* a synonym of *joya* Dognin.)

*callides* Dyar, Harrison G., *Thecla*

Type Locality: La Chorrera, April, 1912; Trinidad River, March, 1912, Panamá.

Location of Type: United States National Museum, no. 15,760.

Original Description: 1915, Proc. U. S. Natl. Mus., vol. 47, p. 151 (Washington, D. C.)

Additional Reference: Schaus, William, 1920, Ent. News, vol. 31, p. 176 (Philadelphia, Pa.). (Makes *callides* Dyar a synonym of *autoclea* Hewitson.)

*callirrhoe* Goodson, F. W., *Thecla*

Type Locality: "1 ♀ (no locality), ex coll. Semper. Unfortunately the body is missing."

Location of Type: British Museum (Natural History).

Original Description: 1945 (December), Entomologist, vol. 78, p. 185 (London).

*calor* Druce, Hamilton H., *Thecla*

Type Locality: Tapajos River, Brazil; Chapada Campo, Brazil, November-December.

Location of Type: Druce Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 163 (London).

Additional Reference: Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 798, pl. 158-e (Stuttgart).

*caltha* Druce, Hamilton H., *Thecla*

Type Locality: Santarem, Amazonas, Brazil.

Location of Type: Druce Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 591, pl. 34, fig. 19 ♂ (London).

*calus* Godart, Jean B., *Polyommatus*

Type Locality: America.

Location of Type:

Original Description: 1822 Encyclopédie Méthodique, vol. 9, p. 640 (Paris).

Additional Reference: Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 188, vol. 2, pl. 75, figs. 585, 586 ♂ (London).

*cambes* Godman, F. D. and O. Salvin, *Thecla*

Type Locality: Cordova, Mexico.

Location of Type: British Museum (Natural History).

Original Description: 1887 (August), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 53, vol. 3, pl. 54, figs. 16, 17 ♂, 18 ♀ (London).

Note: Godman and Salvin say that the female figured is associated with some doubt.

Synonyms: *syvix* Dyar.

*camissa* Hewitson, W. C., *Thecla*

Type Locality: Sarayaco, Ecuador.

Location of Type: British Museum (Natural History).

Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 66 (London).

Additional Reference: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 189, vol. 2, pl. 75, figs. 595, 596 ♂ (London). Additional locality: Nicaragua (Chontales).

Synonyms: *charichlorus* Butler and Druce, *vespasianus* Butler and Druce.

*campa* Jones, E. Dukinfield, *Thecla*

Type Locality: Castro, Paraná, Brazil.

Location of Type: Jones Collection.

Original Description: 1912, Proc. Zool. Soc. London, p. 901, pl. 97, fig. 14 (London).

*cana* Hayward, Kenneth J., *Thecla*

Type Locality: Villa Nogués, Tucumán, Argentina.

Location of Type: Fundación Miguel Lillo, Tucumán.

Original Description: 1949, Acta Zool. Lilloana, vol. 8, p. 571, pl., fig. 7 (Tucumán, Argentina).

*canacha* Hewitson, W. C., *Thecla*

Type Locality: Venezuela.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 187, vol. 2, pl. 74, figs. 583, 584 ♂ (London).

*candar* Dyar, Harrison G., *Thecla* (not Druce) Nomen nudum. See *candor* Druce

Type Locality: Tincochaca, Peru, 7,000 ft., August 9, 1911.

Location of Type:

Original Description: 1913, Proc. U. S. Natl. Mus., vol. 45, p. 636 (Washington, D. C.).

Note: This is a misspelling of *candor* Druce.

*candidus* Druce, Hamilton H., *Thecla*

Type Locality: Río Minero, Muzo, Colombia, 2,500 ft.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 571, pl. 31, figs. 1 ♂, 2 ♀ (London).

*candor* Druce, Hamilton H., *Thecla*

Type Locality: Huancabamba, North Peru, 6,000–10,000 ft.

Location of Type: Druce Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 578, pl. 33, fig. 1 ♂ (London).

Additional Reference: Druce, H. H., 1909 (September), Trans. Ent. Soc. London, p. 433 (London). (Makes *candor* a synonym of *amatista* Dognin.)

Synonyms: *candar* Dyar.

*caninius* Druce, Hamilton H., *Thecla*

Type Locality: Venezuela.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 585, (London).

Additional Reference: Draudt, Max, 1920 (January), The Macrolepidoptera of the World, vol. 5, p. 770, pl. 154-e (Stuttgart).

*canitus* Druce, Hamilton H., *Thecla*

Type Locality: Paraguay.

Location of Type: Druce Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 604, pl. 36, fig. 8 ♂ (London).

*canus* Druce, Hamilton H., *Thecla*

Type Locality: Chilpancingo, Guerrero, Mexico, 4,600 ft., June.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 624 (London).

Additional Reference: Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 806, pl. 159-g (Stuttgart).

Synonyms: *bunnirae* Dyar.

*capeta* Hewitson, W. C., *Thecla*

Type Locality: Nicaragua.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diural Lepidoptera, vol. 1, p. 193, vol. 2, pl. 77, figs. 614, 615 ♀ (London).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 75 (London). (Think that the type is a male and not a female.)

*caramba* Clench, Harry K., *Thecla*

Type Locality: Massaranduba-Blumenau, Sta. Cartharina, Brazil.

Location of Type: American Museum of Natural History.

Original Description: 1944 (September), Jour. New York Ent. Soc., vol. 52, p. 255 (New York, N. Y.).

*caranus* Cramer, Pierre, *Papilio*

Type Locality: Surinam.

Location of Type:

Original Description: 1780, Papillons exotiques des trois parties du monde, vol. 4, p. 84, pl. 332, figs. C, D (Amsterdam).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 24, vol. 3, pl. 50, figs. 13, 13a, 14 ♂, 15 ♀ (London).

Synonyms: *ceranus* Fabricius.

*cardus* Hewitson, W. C., *Thecla*
Type Locality: Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 151, vol. 2, pl. 60, figs. 395, 396 ♂, 394 ♀ (London).

*carla* Schaus, William, *Thecla*
Type Locality: Colombia.
Location of Type: United States National Museum, no. 5923.
Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 408 (Washington, D. C.).

*carnica* Hewitson, W. C., *Thecla*
Type Locality: Amazon.
Location of Type: British Museum (Natural History).
Original Description: 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 143, vol. 2, pl. 57, fig. 352 ♂ (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 86 (London). (Give Central American localities.)

*carolyna* Comstok, John A., *Plebeius*
Type Locality. Tehachapi Mountains, California.
Location of Type: Southwest Museum.
Original Description: 1922, Bull. So. Calif. Acad. Sci., vol. 21, p. 46, pl. 3 (Los Angeles, Calif.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 462 (Los Angeles, Calif.). (Places *carolyna* as a form male of *chlorina* Skinner.)

*carpasia* Hewitson, W. C., *Thecla*
Type Locality: Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 15 (London).
Additional Reference: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 116, vol. 2, pl. 47, figs. 223, 224 (London).

*carpophora* Hewitson, W. C., *Thecla*
Type Locality: Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 16 (London).
Additional References: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 116, vol. 2, pl. 47, figs. 221, 222 ♂; 1874 (December), *op. cit.*, vol. 1, p. 182, vol. 2, pl. 72, fig. 547 ♀ (London). Draudt, Max, 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 750 (Stuttgart). (Makes *carpophora* a subspecies of *inachus* Cramer.)

*carteia* Hewitson, W. C., *Thecla*
Type Locality: Canelos, Ecuador.

Location of Type: British Museum (Natural History).

Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 64 (London).

Additional Reference: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 164, vol. 2, pl. 64, figs. 451, 452 ♂ (London).

*carteri* Weeks, A. G., Jr., *Thecla*

Type Locality: Suapure, Venezuela.

Location of Type: Museum of Comparative Zoology.

Original Description: 1906 (June), Ent. News, vol. 17, p. 197 (Philadelphia, Pa.).

Additional Reference: Weeks, A. G., Jr., 1911, Illus. of Diurnal Lepidoptera, vol. 2, p. 4, pl. 3, fig. 2 (Boston, Mass.).

*carthaea* Hewitson, W. C., *Thecla*

Type Locality: Mexico.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 15 (London).

Additional Reference: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 116, vol. 2, pl. 47, figs. 215, 216 ♂ (London).

*caryaevorus* McDunnough, James H., *Strymon*

Type Locality: Merivale, Ontario, June 12, 1941.

Location of Type: Canadian National Collection, no. 5262.

Original Description: 1942 (January), Can. Ent., vol. 74, p. 1 (Guelph, Ontario).

Additional Reference: Michener, C. D. and C. F. dos Passos, 1942, Amer. Mus. Novitates, no. 1210, p. 5, fig. 3 (New York, N. Y.).

*casasi* Comstock, W. P. and E. I. Huntington, *Thecla acis*

Type Locality: Santiago de Cuba.

Location of Type: American Museum of Natural History.

Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 66, pl. 1, fig. 1 ♀ (New York, N. Y.).

*casmilla* Hewitson, W. C., *Thecla*

Type Locality: Brazil.

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 177, vol. 2, pl. 70, figs. 521, 522 ♀ (London).

*cassidula* Boisduval, Jean A., *Lycaena*

Type Locality: Honduras.

Location of Type:

Original Description: 1870, Considérations sur des Lépidoptères Envoyés du Guatemala a M. de l'Orza, p. 16 (Rennes).

Additional Reference: Draudt, Max, 1921, The Macrolepidoptera of the World, vol. 5, p. 820 (Stuttgart). (Makes *cassidula* a form of *marina* Reakirt.)

*cassioides* Boisduval, Jean A., *Lycaena*
Type Locality: Honduras and Mexico.
Location of Type:
Original Description: 1870, Considérations sur des Lépidoptères Envoyés du Guatemala à M. de l'Orza, p. 16 (Rennes).
Additional Reference: Draudt, Max, 1921, The Macrolepidoptera of the World, vol. 5, p. 820 (Stuttgart). (Makes *cassioides* a synonym of *marina* Reakirt.)

*cassius* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1775, Papillons exotiques des trois parties du monde, vol. 1, p. 36, pl. 23, figs. C, D (Amsterdam).
Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 89, pl. 1, fig. 21 ♀ (New York, N. Y.).
Subspecies: *striata* Edwards, *catilina* Fabricius, *theonus* Lucas, *floridensis* Morrison syn., *chadwicki* Comstock and Huntington.

*castalis* Edwards, William H., *Thecla*
Type Locality: Waco, Texas.
Location of Type:
Original Description: 1871 (January), Trans. Amer. Ent. Soc., vol. 3, p. 208 (Philadelphia, Pa.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 25, no. 401 (Los Angeles, Calif.). (Places *castalis* as a subspecies of *damon* Cramer.)
Synonyms: *brehmei* Barnes and Benjamin, *discoidalis* Skinner.

*castimonia* Druce, Hamilton H., *Thecla*
Type Locality: Interior of Colombia.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 580, pl. 33, fig. 6 ♂ (London).

*castitas* Druce, Hamilton H., *Thecla talayra* var.
Type Locality: Pará, Espiritu Santo, Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 579 (London).
Additional Reference: Draudt, Max, 1919 (December), The Macrolepidoptera of the World, vol. 5, p. 763, pl. 154-c (Stuttgart). (Makes *castitas* a form of *talayra* Hewitson.)

*castrena* Jones, E. Dukinfield, *Thecla*
Type Locality: Castro, Paraná, Brazil.
Location of Type: Jones Collection.
Original Description: 1912, Proc. Zool. Soc. London, p. 900, pl. 97, figs. 12, 13 (London).

Additional Reference: Schaus, William, 1920, Ent. News, vol. 31, p. 176 (Philadelphia, Pa.). (Places *castrena* Jones female as a synonym of *tella* Schaus.)

*castro* Reakirt, Tryon, *Polyommatus*
Type Locality: Rocky Mountains, Colorado.
Location of Type: Strecker Collection (2 ♀♀), Field Museum, Chicago, Illinois.
Original Description: 1866 (June), Proc. Ent. Soc. Phila., vol. 6, p. 148 (Philadelphia, Pa.).
Additional Reference: Barnes, William and J. H. McDunnough, 1917 (February), Check list of the Lepidoptera of Boreal America, p. 15, no. 407 (Decatur, Illinois). (Places *castro* as a synonym of *helloides* Boisduval.)

*catadupa* Hewitson, W. C., *Thecla*
Type Locality: Ecuador.
Location of Type: British Museum (Natural History).
Original Description: 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 117, vol. 2, pl. 47, figs. 219, 220 ♂ (London).

*catalina* Reakirt, Tryon, *Lycaena*
Type Locality: California.
Location of Type: Strecker Collection (1 ♂, 1 ♀), Field Museum, Chicago, Illinois.
Original Description: 1866 (June), Proc. Acad. Nat. Sci., Phila., vol. 6, p. 244 (Philadelphia, Pa.).
Additional Reference: Barnes, William, and J. H. McDunnough, 1917 (February), Check list of the Lepidoptera of Boreal America, p. 16, no. 448 (Decatur, Illinois). (Places *catalina* as a race of *piasus* Boisduval.)
Synonyms: *gorgonioi* Gunder, *rhaea* Boisduval.

*catharina* Draudt, Max, *Thecla*
Type Locality: Santa Catharina, Brazil.
Location of Type: Wernicke Collection.
Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 788, pl. 156-k (Stuttgart).

*catharinae* Capronnier, J. B., *Thecla* Nomen nudum
Type Locality: Botafogo, Brazil.
Location of Type:
Original Description: 1874, Ann. Soc. Ent. Beligique, vol. 17, p. 15 (Bruxelles).

*catharinensis* Clench, Harry K., *Thecla acaste*
Type Locality: Santa Catharina, Brazil.
Location of Type: Museum of Comparative Zoology, no. 26,226.
Original Description: 1944 (July), Bull. Mus. Comp. Zool., vol. 94, p. 242 (Cambridge, Mass.).

*catilina* Fabricius, Johann Christian, *Hesperia*
Type Locality: "Americae meridionalis Insulis".

Location of Type:

Original Description: 1793, Entomologica Systematica, vol. 3, pt. 1, p. 304 (Hafniae).

Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 91, pt. 1, figs. 29, 30 ♀ (New York, N. Y.). (Make *catilina* a subspecies of *cassius* Cramer.)

*catrea* Hewitson, W. C., *Thecla*

Type Locality: Brazil.

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 181, vol. 2, pl. 71, figs. 545, 546 ♂ (London).

*caulonia* Hewitson, W. C., *Thecla*

Type Locality: Rio de Janeiro.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 188, vol. 2, pl. 75, figs. 587, 588 ♀ (London).

Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 609 (London). (Makes *caulonia* a synonym of *beon* Cramer.)

*cauter* Druce, Hamilton H., *Thecla*

Type Locality: Chapada Campo, Brazil, September–November, male and female.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 589, pl. 34, fig. 15 ♂ (London).

*cecina* Hewitson, W. C., *Thecla*

Type Locality: Guatemala (Polochic Valley).

Location of Type: Salvin and Godman Collection. British Museum?

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 34, (London).

Additional Reference: Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 202 (London). (Makes *cecina* Hewitson synonym of *"janais"* Cramer.)

*cecrops* Fabricius, Johann Christian, *Hesperia*

Type Locality: "In Indiis".

Location of Type:

Original Description: 1793, Entomologica Systematica, vol. 3, p. 270 (Hafniae).

Synonyms: *poeas* Hübner, *gottschalki* Clark.

*ceglusa* Hewitson, W. C., *Thecla*

Type Locality: Amazon.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 22 (London).

Additional Reference: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 138, vol. 2, pl. 55, figs. 330, 331 ♂ (London).

*celelata* Hewitson, W. C., *Thecla*
Type Locality: Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 181, pl. 71, figs. 543, 544 ♀ (London).

*celida* Lucas, P. H., *Thecla*
Type Locality: Cuba.
Location of Type: British Museum (Natural History)?
Original Description: 1857, *in* Sagra, Historie physique, politique et naturelle de l'ile de Cuba, vol. 7, p. 610 (Paris).
Additional Reference: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 125, vol. 2, pl. 49, figs. 246, 247 ♂ (London).
Subspecies: *shoumatoffi* Comstock and Huntington, *aibonito* Comstock and Huntington.

*celmus* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1775, Papillons exotiques des trois parties du monde, vol. 1, p. 87, pl. 55, figs. G, H (Amsterdam).
Additional References: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 140, vol. 2, pl. 56, figs. 338, 339 ♂ (London). Amazon, Venezuela, Nicaragua, Rio de Janeiro. Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 85 (London). (Give additional localities.)
Synonyms: *pereza* Butler.

*celona* Hewitson, W. C., *Thecla*
Type Locality: Espiritu Santo.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 179, vol. 2, pl. 70, figs. 529, 530 ♂ (London).

*centoripa* Hewitson, W. C., *Thecla*
Type Locality: Amazon.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 23 (London).
Additional Reference: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 183, vol. 2, pl. 73, figs. 562, 563 ♂ (London).
Synonyms: *hahneli* Staudinger.

*centralis* Barnes, William and James H. McDunnough, *Philotes battoides*
Type Locality: Salida, Colorado, July 1–7.
Location of Type: United States National Museum (Barnes Collection). Paratype in American Museum of Natural History.

Original Description: 1917 (March), Contributions to the natural history of the Lepidoptera of North America, vol. 3, no. 4, p. 215, pl. 16, figs. 7, 8 (Decatur, Illinois).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 466 (Los Angeles, Calif.). (Places *centralis* as a subspecies of *glaucon* Edwards.)

*centuncula* Draudt, Max, *Thecla*

Type Locality: Sao Paulo, Brazil.

Location of Type:

Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 805, pl. 159-f (underside female) (Stuttgart).

*ceranus* Fabricius, Johann Christian, *Hesperia* Rurales (not Cramer)
Misspelling of *caranus* Cramer

Type Locality: "India".

Location of Type:

Original Description: 1793, Entomologica Systematica, vol. 3, pt. 1, p. 276, no. 66 (Hafniae).

Additional Reference: Goodson, F. W., 1945 (December), Entomologist, vol. 78, p. 186 (London). (Calls attention to the misspelling of *caranus* Cramer by Fabricius, and repeated by Godart and Butler.)

*cerata* Hewitson, W. C., *Thecla*

Type Locality: Pará.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 191, vol. 2, pl. 76, figs. 607, 608 ♂ (London).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 84 (London). (Give Central American localities.)

Subspecies: *palumbes* Druce.

*ceraunus* Fabricius, Johann Christian, *Hesperia*

Type Locality: "Americae meridionalis Insulis".

Location of Type:

Original Description: 1793, Entomologica Systematica, vol. 3, pt. 1, p. 303 (Hafniae).

Additional Reference: 1943 (December), Comstock, W. P. and E. I. Huntington, Ann. New York Acad. Sci., vol. 45, p. 107 (New York, N. Y.). (Make *ceraunus* a subspecies of *hanno* Stoll.)

Subspecies: *ramon* Dognin.

*ceromia* Hewitson, W. C., *Thecla*

Type Locality: Amazon.

Location of Type: British Museum (Natural History).

Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 185, vol. 2, pl. 74, figs. 573, 574 ♂ (London).

Synonyms: *suada* Hewitson.

*cestri* Reakirt, Tryon, *Thecla*
Type Locality: Near Vera Cruz, Mexico.
Location of Type:
Original Description: 1866 (November), Proc. Acad. Nat. Sci. Phila., p. 338 (Philadelphia, Pa.).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 96, vol. 3, pl. 58, figs. 12, 13 ♂ (London). (Give Central American localities.)
Subspecies: *peruensis* Dufrane.

*cethegus* Stoll, Caspar, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1790, Papillons exotiques des trois parties du monde, Supplement, p. 168, pl. 38, figs. 5, 5E (Amsterdam).
Additional References: Sepp, Jan. 1855, Surinaamsche Vlinders, vol. 2, p. 195, pl. 86 (Amsterdam). Druce, H. H., 1907, Proc. Zool. Soc. London, p. 568 (London). (Does not recognize the species.)

*cetra* Draudt, Max, *Thecla*
Type Locality: Muzo, Colombia.
Location of Type: Fassl Collection (now in Naturhistorisches Museum, Basle).
Original Description: 1920 (January), The Macrolepidoptera of the World, vol. 5, p. 776, pl. 155-c (Stuttgart) (underside male).

*chacona* Jörgensen, Pedro, *Thecla cecrops* form
Type Locality: Formosa, Argentina.
Location of Type: Jörgensen Collection.
Original Description: 1932, Deutsche Ent. Zeit. (Iris), vol. 46, p. 45 (Dresden).
Note: Probably a form of *beon* Cramer and not of *cecrops* Fabricius.

*chadwicki* Comstock, W. P. and E. I. Huntington, *Leptotes cassius*
Type Locality: Roseau Valley, Dominica, B. W. I., April 11, 1929.
Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 93, pl. 1, fig. 28 ♀ (New York, N. Y.).

*chalcis* Edwards, William H., *Thecla*
Type Locality. California (1 ♂).
Location of Type:
Original Description: 1869 (September), Trans. Amer. Ent. Soc., vol. 2, p. 376 (Philadelphia, Pa.).

*chaluma* Schaus, William, *Thecla*
Type Locality: St. Catherina, Brazil.
Location of Type: United States National Museum, no. 5937 ♀.
Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 414 (Washington, D. C.).

*charichlorus* Butler, A. G. and Herbert Druce, *Tmolus*
Type Locality: Cartago, Costa Rica.
Location of Type: British Museum (Natural History).
Original Description: 1872 (July), Cistula Entomologica, vol. 1, p. 109 (London).
Additional References: Butler, A. G., 1873 (October), Lepid. Exot., p. 162, pl. 57, fig. 10 (London). Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 189 (London). (Makes *charichlorus* a synonym of T. *camissa* Hewitson.)

*charlottensis* Holland, William J., *Chrysophanus*
Type Locality: Queen Charlotte Island, British Columbia, August 1, 1912.
Location of Type: Carnegie Museum, Pittsburgh, Pennsylvania.
Original Description: 1930, Ann. Carnegie Mus., vol. 20, p. 6 (Pittsburgh, Pa.).

*chilensis* Blanchard, E., *Lycaena*
Type Locality: Coquimbo, Chile.
Location of Type:
Original Description: 1852, Historia Física y Política de Chile, Zoologica, vol. 7, p. 37; 1854, op. cit., Atlas, vol. 2, pl. 2 (3), figs. 4a, 4b (Paris) (Gay's Fauna of Chile).
Synonyms: *atahualpa* Wallengren.

*chilica* Schaus, William, *Thecla*
Type Locality Castro, Parana, Brazil.
Location of Type: United States National Museum, no. 5956 ♂.
Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 422 (Washington, D. C.).

*chione* Goodson, F. W., *Thecla*
Type Locality: "Cauca Valley, Torne, August, '07, Colombia" (1 ♂). Amazon (Bates), ex coll. Felder (1 ♂).
Location of Type: British Museum (Natural History).
Original Description: 1945 (December), Entomologist, vol. 78, p. 185 (London).

*chiriquensis* Niepelt, W., *Theorema*
Type Locality: Chiriqui, Panama, 1 male.
Location of Type: Niepelt Collection.
Original Description: 1927, Intern. Ent. Zeit., vol. 21, p. 51, pl. opp. p. 182, fig. 6 ♂ type (Guben).

*chiton* Fabricius, Johann Christian, *Hesperia*
Type Locality: "Habitat in India".
Location of Type: Lost (H. H. Druce).
Original Description: 1793, Entomologica Systematica, vol. 3, p. 262 (Hafniae).
Additional References: Donovan, Edward, 1800, Ins. India, p. 41, pl. 39, fig. 1 (London). Godman, F. D. and O. Salvin, 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 23 (London). (Make *chiton* a synonym of *phaleros* Linnaeus.) Druce, H. H., 1907, Proc. Zool. Soc. London, p. 567 (London).

*chlamydem* Druce, Hamilton H., *Thecla*
Type Locality: Pozuzo, Peru, 5,000–6,000 ft.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 577, pl. 32, fig. 10 ♂ (London).

*chlamys* Druce, Hamilton H., *Thecla*
Type Locality: South Paraguay.
Location of Type: Godman Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 584, pl. 34, fig. 3 ♂ (London).

*chlorina* Skinner, Henry, *Lycaena*
Type Locality: Tehachapi, California, July 6.
Location of Type: Academy of Natural Sciences, Philadelphia, Pennsylvania.
Original Description: 1892 (January), Ent. News, vol. 13, p. 15 (Philadelphia, Pa.).
Synonyms: *carolyna* Comstock.

*chloris* Hewitson, W. C., *Thecla*
Type Locality: Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 202, vol. 2, pl. 80, figs. 659, 660 ♀ (London).

*chloris* Field, William D., *Habrodias grunus lorquini* form
Type Locality: Mount Diablo, Contra Costa County, California, June 17, 1931.
Location of Type: F. Martin Brown Collection, Colorado Springs, Colorado.
Original Description: 1938, Bull. So. Calif. Acad. Sci., vol. 37, pt. 1, p. 28 (Los Angeles, Calif.).

*chlorophora* Watson, Frank E. and William P. Comstock, *Strymon saepium*
Type Locality: San Diego, California, June 14, 1913 (Collector W. S. Wright).
Location of Type: American Museum of Natural History.
Original Description: 1920 (December), Bull. Amer. Mus. Nat. Hist., vol. 42, art. 10, p. 452 (New York, N. Y.).

*chonida* Hewitson, W. C., *Thecla*
Type Locality: Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1874, Ent. Mo. Mag., vol. 11, p. 105 (London).
Additional References: Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 197, vol. 2, pl. 78, figs. 635, 636 (London). Mexico. Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 90 (London). (Say that the type is a female and give locality as Jalapa, Mexico.)

*christophei* Comstock, W. P. and E. I. Huntington, *Thecla*
Type Locality: Port-au-Prince, Haiti, January 1–6, 1922.
Location of Type: American Museum of Natural History.
Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 85, pl. 1, figs. 9, 10 ♀ (New York, N. Y.).

*chrysalus* Scudder, Samuel H., *Hypaurotis* (not Edwards)
Misspelling of crysalus Edwards
Type Locality:
Location of Type:
Original Description: 1876 (May), Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 113 (Buffalo, N. Y.).

*cilla* Behr, Hermann, *Lycaena*
Type Locality: Headwaters Tuolumne River, California, elev. 11,000 ft.
Original Description: 1867 (January), Proc. Calif. Acad. Nat. Sci., vol. 3, p. 281 (San Francisco, Calif.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 452 (Los Angeles, Calif.). Places *cilla* as a synonym of *aquilo podarce* C. and R. Felder.)

*cillutincarae* Draudt, Max, *Thecla loxurina* form
Type Locality: Bolivia, 3,000 meters.

Location of Type:
Original Description: 1919 (December), The Macrolepidoptera of the World, vol. 5, p. 758, pl. 153-e (Stuttgart).

*cimelium* Gosse, Philip Henry, *Thecla*
Type Locality: Paraguay, December–February.
Location of Type: British Museum (Natural History).
Original Description: 1880 (September), Entomologist, vol. 13, p. 203, pl. 2, fig. 2 ♂ (London).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 593 (London).

*cinerea* Edwards, William H., *Lycaena pseudargiolus* form *violacae* var.
Type Locality: Arizona.
Location of Type:
Original Description: 1883 (January), Papilio, vol. 3, p. 8 (New York, N. Y.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 29, no. 475 (Los Angeles, Calif.). Places *cinerea* as a subspecies of *pseudargiolus* Boisduval and LeConte.)
Synonyms: *arizonensis* Edwards.

*cinerea* Lathy, Percy I., *Thecla*
Type Locality: Rio Grande do Sul, Brazil.
Location of Type: Fournier Collection (Paris).
Original Description: 1936, Livre Jubilaire de M. Eugene-Louis Bouvier, p. 231, pl. 8, fig. 11 (Paris).

*cinniana* Hewitson, W. C., *Thecla*
Type Locality: Amazon.
Location of Type: British Museum (Natural History).
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 189, vol. 2, pl. 75, figs. 593, 594 ♀ (London).

*circinata* Hewitson, W. C., *Thecla*
Type Locality: Bolivia.
Location of Type: British Museum (Natural History).
Original Description: 1874 (November), Bolivian Butterflies Collected by Mr. Buckley, p. 19 (London).
Additional Reference: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 199, vol. 2, pl. 79, figs. 645, 646 ♂ (London).

*cissusa* Hewitson, W. C., *Thecla*
Type Locality: Pará.
Location of Type: British Museum (Natural History).
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 188, vol. 2, pl. 75, figs. 589, 590 ♂ (London).

*cithonius* Godart, Jean B., *Polyommatus*
Type Locality: Guiana.
Location of Type:
Original Description: 1822, Encyclopédie Méthodique, vol. 9, p. 633 (Paris).

*citima* Edwards, Henry, *Thecla crysalus* var.
Type Locality: Mount Nebo, Utah, August, 1875.
Location of Type: American Museum of Natural History (1 ♀).
Original Description: 1881 (April), Papilio, vol. 1, p. 53 (New York, N. Y.).

*clara* Kirby, W. F., *Cupido* (not Edwards) Nomen nudum
Type Locality:
Location of Type:
Original Description: 1871, A Synonymic Catalogue of Diurnal Lepidoptera, p. 376, no. 306 (London).
Additional Reference: Scudder, Samuel H., 1876 (May), Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 124 (Buffalo, N. Y.). (Says there is no description of *clara* Edwards.)

*clara* Edwards, Henry, *Lycaena*
Type Locality: Colorado and the mountains of California.
Location of Type: American Museum of Natural History (3 females from Tehachepi, California).
Original Description: 1880, Pacific Coast Lepidoptera, no. 26, 1 page (New York, N. Y.).
Note: Pacific Coast Lepidoptera, nos. 1–22, are reprints from Proc. Calif. Acad. Sci.; nos. 23–30 are reprints as the 1877–1878 volumes of the Proceedings were never published.

*clarina* Hewitson, W. C., *Thecla*
Type Locality: Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 173, vol. 2, pl. 68, figs. 497, 498 ♂ (London).

*clarionensis* Van Duzee, E. P., *Thecla melinus* (Heid, Graham H. MS)
Type Locality: Clarion Island, Mexico, April 30, 1925.
Location of Type: California Academy of Science Museum, no. 3749 ♂.
Original Description: 1933, Proc. Calif. Acad. Sci., Series 4, vol. 21, p. 143.

*clarissa* Draudt, Max, *Thecla*
Type Locality: Sao Paulo, Brazil.
Location of Type:
Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 797, pl. 158-d (underside male) (Stuttgart).

*clarki* Freeman, T. N., *Incisalia niphon* var.
Type Locality: Constance Bay, Ottawa Region, Ontario, Canada, June 4, 1938.
Location of Type: Canadian National Collection, Ottawa, no. 4430.
Original Description: 1938 (December), Can. Ent., vol. 70, p. 247 (Orillia, Ontario).

*claytoni* Brower, A. E., *Lycaena dorcas*
Type Locality: Springfield, Maine, July 27, 1938.
Location of Type: United States National Museum (Paratype in American Museum of Natural History).
Original Description: 1940, Bull. Brooklyn Ent. Soc., vol. 35, p. 138 (Brooklyn, N. Y.).

*clenchi* Comstock, W. P. and E. I. Huntington, *Thecla maesites*
Type Locality: Roseau Valley, Dominica, B. W. I., April.
Location of Type: American Museum of Natural History.
Original Description: 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 72, pl. 1, fig. 8 ♂ (New York, N. Y.).

*cleocha* Hewitson, W. C., *Thecla*
Type Locality: Curaray, Ecuador.
Location of Type: British Museum (Natural History).
Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 62 (London).
Additional Reference: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 169, vol. 2, pl. 66, figs. 475, 476 (London).

*cleon* Fabricius, Johann Christian, *Papilio*
Type Locality: Brazil.
Location of Type: Banksian Collection, British Museum (Natural History).
Original Description: 1775, Systema Entomologia, p. 522, (Flensburgi).
Additional References: Butler, A. G., 1869, Catalogue of Diurnal Lepi-

doptera Described by Fabricius in the Collection of the British Museum, p. 188, pl. 2, figs. 4, 6 (London). Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 142, vol. 2, pl. 56, figs. 347, 348, 349 ♂ (London). (Rio de Janeiro.)

Synonyms: *ecbatana* Hewitson.

*clepsydra* Druce, Hamilton H., *Thecla*

Type Locality: Bogotá, Colombia.

Location of Type: British Museum (Natural History).

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 607, pl. 36, fig. 10 ♂ (London).

Additional Reference: Draudt, Max, 1920 (January), The Macrolepidoptera of the World, vol. 5, p. 775 (Stuttgart). (Includes *clepsydra* as a synonym of *arpoxais* Godman and Salvin.)

Note: Draudt's figure is poor, the synonymy is questionable.

*climicles* Dyar, Harrison G., *Thecla*

Type Locality: Taboga Island, Panama.

Location of Type: United States National Museum, no. 15,758.

Original Description: 1915, Proc. U. S. Natl. Mus., vol. 47, p. 150 (Washington, D. C.).

Additional Reference: Schaus, William, 1920, Ent. News, vol. 31, p. 176 (Philadelphia, Pa.). (Makes *climicles* a synonym of *proba* Godman and Salvin.)

*clitumnus* Butler, A. G., *Tmolus*

Type Locality: Prainha, Brazil, December 6, 1874.

Location of Type: British Museum (Natural History).

Original Description: 1877 (June), Trans. Ent. Soc. London, p. 140, pl. 3, fig. 6 (London).

Additional Reference. Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 613 (London). (Makes *clitumnus* a synonym of *atrius* Herrich-Schäffer.)

*clothilde* Edwards, William H., *Thecla*

Type Locality: Quebec, C. E.

Location of Type:

Original Description: "1863" [1864], Proc. Ent. Soc. Phila., vol. 2, p. 15 (Philadelphia, Pa.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 25, no. 418 (Los Angeles, Calif.). (Places *clothilde* as a synonym of female *laeta* Edwards.)

*clytie* Edwards, William H., *Thecla*

Type Locality: San Antonio, Texas.

Location of Type:

Original Description: 1877 (November), Field and Forest, vol. 3, p. 88 (Washington, D. C.).

Additional References: Edwards, W. H., 1882 (February), Papilio, vol. 2, p. 24 (New York, N. Y.). Holland, W. J., 1931, The Butterfly Book, Rev. Ed., p. 241, pl. 30, fig. 6 ♀ type (Garden City, N. Y.). Barnes, W. and

J. H. McDunnough, 1912 (July), Contributions to the natural history of the Lepidoptera of North America, vol. 1, no. 4, p. 57, pl. 27, fig. 3 (Decatur, Illinois).

Synonyms: *maevia* Godman and Salvin (winter form).

*coccineifrons* Godman, F. D. and O. Salvin, *Thecla*

Type Locality: Nicaragua (Chontales), also Santa Marta, Colombia.

Location of Type: British Museum (Natural History).

Original Description: 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 23, vol. 3, pl. 50, figs. 7, 8 ♂, 9 ♀ (London).

*cockaynei* Goodson, F. W., *Thecla*

Type Locality: "1 ♂ (no locality), ex Hewitson Coll. 1 ♂, British Museum Coll., Venezuela."

Location of Type: British Museum (Natural History).

Original Description: 1945 (December), Entomologist, vol. 78, p. 187 (London).

*coelebs* Herrich-Schäffer, G. A. W., *Thecla*

Type Locality: Cuba.

Location of Type:

Original Description: 1862, Corresp.-Blatt. Zool.-Min. Ver., vol. 16, p. 142 (Regensburg).

Additional References: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 156, vol. 2, pl. 62, figs. 416, 417 (London). Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 61 (New York, N. Y.).

*coelicolor* Butler, A. G. and Herbert Druce, *Strymon*

Type Locality: Cartago, Costa Rica.

Location of Type: Coll. Druce (British Museum).

Original Description: 1872, Cistula Entomologica, vol. 1, p. 106 (London).

Additional Reference: Butler, A. G., 1873 (October), Lepid. Exot., p. 158, pl. 57, fig. 6 (London).

Synonyms: *hena* Hewitson.

*cogina* Schaus, William, *Lycaena*

Type Locality: Castro, Parana, Brazil.

Location of Type: United States National Museum, no. 5920.

Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 407 (Washington, D. C.).

*collina* Philippi, R. A., *Lycaena*

Type Locality: Santiago, Chile.

Location of Type:

Original Description: 1860, Linnaea Entomologica Zeitschrift, vol. 14, p. 270 (Berlin).

Synonyms: *lyrnessa* Hewitson.

*collucia* Hewitson, W. C., *Thecla*

Type Locality:

Location of Type: British Museum (Natural History).
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 186, vol. 2, pl. 74, figs. 577, 578 ♀ (London).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 624 (London). (Makes *collucia* a synonym of *badaca* Hewitson.)

*collustra* Druce, Hamilton H., *Thecla*
Type Locality: Caparo, Trinidad, B. W. I.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 600, pl. 35, fig. 15 ♂ (London).

*color* Druce, Hamilton H., *Thecla*
Type Locality: British Guiana.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 582, pl. 33, fig. 11 ♂ (London).

*coloradensis* Gunder, J. D., *Heodes heteronea* ab. ♂
Type Locality: Plain View, Colorado, July 1924.
Location of Type: American Museum of Natural History.
Original Description: 1925 (July), Ent. News, vol. 36, p. 194, pl. V, fig. 1 (Philadelphia, Pa.).

*columbia* Skinner, Henry, *Lycaena lygdamus*
Type Locality: Fort Columbia, Washington, April 25, 1916.
Location of Type: Academy of Natural Sciences, Philadelphia, Pennsylvania.
Original Description: 1917 (May), Ent. News, vol. 28, p. 213 (Philadelphia, Pa.).

*columbia* McDunnough, James H., *Callipsyche behrii* var. nov.
Type Locality: Fairview, British Columbia, June 12, 1919.
Location of Type: Canadian National Collection, Ottawa, no. 5474 ♂.
Original Description: 1944 (September), Can. Ent., vol. 76, no. 9, p. 190 (Guelph, Canada).

*columbiae* Mattoni, R. H. T., *Philotes enoptes*
Type Locality: Columbia River near Brewster, Okanogan County, Washington, May 5, 1947.
Location of Type: United States National Museum.
Original Description: 1954 (December), Bull. Southern Calif. Acad. Sciences, vol. 53, pt. 3, p. 162, pl. 43, figs. 7, 11 (Los Angeles, Calif.).

*columbicola* Strand, Embrik, *Thecla*
Type Locality: Colombia (2 ♂♂).
Location of Type: Niepelt Collection.
Original Description: 1916 (December), Lepidoptera Niepeltiana, pt. 2, p. 16, pl. 14, figs. 27, 28 (Berlin).

*columbinia* Strand, Embrik, *Thecla*
Type Locality: Colombia (1 ♂).

Location of Type: Niepelt Collection.

Original Description: 1916 (December), Lepidoptera Niepeltiana, pt. 2, p. 17, pl. 14, figs. 25, 26 (Berlin).

*columella* Fabricius, Johann Christian, *Hesperia*

Type Locality: "Americae meridionalis Insulis".

Location of Type:

Original Description: 1793, Entomologica Systematica, vol. 3, pt. 1, p. 282 (Hafniae).

Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 79, pl. 1, fig. 13 ♀ (New York, N. Y.). (Fix the type locality as Hispaniola.)

Synonyms: *erytalus* Butler.

Subspecies: *modesta* Maynard, *ocellifera* Grote syn., *cybira* Hewitson, *arecibo* Comstock and Huntington, *istapa* Reakirt.

*comae* Druce, Hamilton H., *Thecla*

Type Locality: Río Minero, Muzo, Colombia, 2,500 ft.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 576, pl. 32, figs. 8 ♂, 9 ♀ (London).

Synonyms: *cornae* (Zool. Record).

*comana* Hewitson, W. C., *Thecla*

Type Locality: Amazon (Tapajos).

Location of Type: British Museum (Natural History).

Original Description: 1867, Illus. of Diurnal Lepidoptera, vol. 1, p. 97, vol. 2, pl. 36, figs. 87, 88 ♂ (London).

Synonyms: *peralta* Moschler.

*commodus* Felder, Cajetan and Rudolf Felder, *Thecla*

Type Locality: Venezuela and New Granada, Bogotá.

Location of Type:

Original Description: 1864–1867, Reise der Osterreichischen Fregatte "Novara" um die Erde, vol. 2, p. 262, pl. 32, figs. 19, 20 ♂ (Wien).

*comstocki* Fox, Charles L., *Plebeius shasta* n. var.

Type Locality: Glacier Point, Yosemite National Park, California, June 11, 1923.

Location of Type: American Museum of Natural History. Paratypes: California Academy of Sciences (San Francisco, Calif.), Southwest Museum (Los Angeles, Calif.).

Original Description: 1924 (April), Ent. News, vol. 35, p. 140 (Philadelphia, Pa.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 458 (Los Angeles, Calif.). (Places *comstocki* as a subspecies of *shasta* Edwards.)

*comstocki* Gunder, J. D., *Philotes sonorensis* form

Type Locality: San Gabriel River, Duarte, Los Angeles County, California, March 15, 1922.

Location of Type: American Museum of Natural History.
Original Description: 1925 (January), Ent. News, vol. 36, p. 6, pl. I, figs. 1, 2, 3 (Philadelphia, Pa.).

*comstocki* Henne, Christopher, *Callophrys*
Type Locality: Providence Mountains, San Bernardino County, California, April 20, 1938.
Location of Type: Collection Los Angeles County Museum.
Original Description: 1940, Bull. So. Calif. Acad. Sci., vol. 39, pt. 1, p. 71 (Los Angeles, Calif.).

*comyntas* Godart, Jean B., *Polyommatus*
Type Locality: North America.
Location of Type: Paris Museum.
Original Description: 1822, Encyclopedie Methodique, vol. 9, p. 660 (Paris).
Additional Reference: Boisduval and LeConte, 1833, Lep. Septentrionalé, p. 120, pl. 36, figs. 6, 7, 8, 9 (Paris).
Synonyms: *meinersi* Field, *sissona* Wright, *watermani* Nakahara.
Subspecies: *albrighti* Clench, *herrii* Grinnell, *arizonensis* Gunder syn., *herii* (Zool. Record) syn., *valeriae* Clench.

*conchylium* Druce, Hamilton H., *Thecla*
Type Locality: Castro, Parana, Brazil and Paraguay.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 598, pl. 35, fig. 12 ♂ (London).

*confusa* Lathy, Percy I., *Thecla*
Type Locality: Peru.
Location of Type: Fournier Collection (Paris).
Original Description: 1936, Livre jubilaire de M. Eugene-Louis Bouvier, p. 231 (Paris).
Note: Lathy said this was the butterfly figured as a female by Hewitson on pl. 66, fig. 472 in Illus. of Diurnal Lepidoptera under *epopea*. He claims figure is of male of another species and names it *confusa*.

*conoveria* Schaus, William, *Thecla*
Type Locality: Petropolis, Brazil.
Location of Type: United States National Museum, no. 5934 ♂.
Original Description: 1902, Proc, U. S. Natl. Mus., vol. 24, p. 413 (Washington, D. C.).

*coolidgei* Gunder, Jean D., *Brephidium exilis* ♀ ab.
Type Locality: Los Angeles, Los Angeles County, California.
Location of Type: American Museum of Natural History.
Original Description: 1925 (January), Ent. News, vol. 36, p. 2, pl. 1, fig. L (Philadelphia, Pa.).

*coolinensis* Watson, Frank E. and William P. Comstock, *Strymon acadica*
Type Locality: Coolin, Idaho.
Location of Type: American Museum of Natural History.

Original Description: 1920 (December), Bull. Amer. Mus. Nat. Hist., vol. 42, art. 10, p. 451 (New York, N. Y.).

*corcorani* Gunder, Jean D., *Atlides halesus* tr. f.
Type Locality: Riverside, Riverside County, California, September 2, 1933.
Location of Type: American Museum of Natural History.
Original Description: 1934 (June), Can. Ent., vol. 66, p. 131 (Orillia, Ontario).

*cordelia* Hewitson, W. C., *Thecla*
Type Locality: Curaray, Ecuador.
Location of Type: British Museum (Natural History).
Original Description: 1870 (March), Equatorial Lepidoptera, Buckley, p. 64 (London).
Additional References: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 165, vol. 2, pl. 65, figs. 453, 454 ♀ (London). Druce, H. H., 1907 (June), Proc, Zool. Soc. London, p. 604 (London). (Makes *cordelia* (♀) a synonym of *ahola* Hewitson (♂).

*cornae—*, *Thecla* Misspelling of *comae* Druce
Type Locality:
Location of Type:
Original Description: 1908, Zool. Record, vol. 44, p. (Insecta) 301 (London).

*corolena* Hewitson, W. C., *Thecla*
Type Locality: Cayenne.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 175, vol. 2, pl. 69, figs. 506, 507 ♂ (London).

*coronata* Hewitson, W. C., *Thecla*
Type Locality: Bogotá and Guatemala.
Location of Type: British Museum (Natural History).
Original Description: 1865, Illus. of Diurnal Lepidoptera, vol. 1, p. 70, vol. 2, pl. 27, figs. 3, 5 ♂, 4 ♀ (London).
Subspecies: *watkinsi* Lathy.

*coronta* Hewitson, W. C., *Thecla*
Type Locality: Cayenne.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 157, vol. 2, pl. 62, figs. 422, 423 ♂ (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 89 (London). (Give also Mexico and Guatemala.)

*cos* Druce, Hamilton H., *Thecla*
Type Locality: Bartica, British Guiana.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 613, pl. 36, fig. 13 ♂ (London).

*cosa* Hewitson, W. C., *Thecla*
Type Locality: None.
Location of Type: British Museum (Natural History).
Original Description: 1867, Illus. of Diurnal Lepidoptera, vol. 1, p. 78, pl. 31, fig. 36 ♂ (London).

*cosmophila* Tessmann, Günter, *Thecla orobiana* f. ♀.
Type Locality: Between La Paz and La Salud, Eastern Peru, 1800 m.
Location of Type:
Original Description: 1928, Mitt. Zool. Museum, vol. 14, Heft 1, p. 125, pl. 5, fig. 8 (Berlin).

*costaricensis* Draudt, Max, *Eumaeus minyas* form
Type Locality: Costa Rica.
Location of Type:
Original Description: 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 745, pl. 146-b (Stuttgart).
Additional Reference: Lathy, Percy I., 1926, Ann. Mag. Nat. Hist., 9th Series, vol. 17, p. 38 (London). (Places *contaricensis* as a synonym of *godartii* Boisduval.)

*cottlei* Grinnell, Fordyce, Jr., *Rusticus acmon*
Type Locality: Baker's Beach, San Francisco, California, March. 1915.
Location of Type: American Museum of Natural History.
Original Description: 1916, Jour. Ent. Zool., vol. 8, p. 83, six figs. (Pomona College, Claremont, Calif.).
Synonyms: *labecula* Watson and Comstock.

*couperi* Grote, Augustus R., *Glaucopsyche*
Type Locality: Anticosti Island, Canada.
Location of Type:
Original Description: 1873 (November), Bull. Buffalo Soc. Nat. Sci., vol. 1, p. 185 (Buffalo, N. Y.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 473 (Los Angeles, Calif.). (Places *couperi* as a subspecies of *lygdamus* Doubleday.)
Synonyms: *leussleri* Gunder, *mcdunnoughi* Gunder.

*couperii* Draudt, Max, *Lycaena* (not Grote) See *couperi* Grote
Type Locality:
Location of Type:
Original Description: 1920 (December), The Macrolepidoptera of the World, vol. 5, p. 816, pl. 144-d (Stuttgart).

*crambusa* Hewitson, W. C., *Thecla*
Type Locality: Bolivia.
Location of Type: British Museum (Natural History).
Original Description: 1874 (November), Bolivian Butterflies Collected by Mr. Buckley, p. 20 (London).
Additional Reference: Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 205, vol. 2, pl. 81, figs. 678, 679 ♂ (London).

*crataegi* Boisduval, Jean A. and John LeConte, *Polyommatus*
Type Locality: Georgia.
Location of Type:
Original Description: 1833, Histoire Générale et iconographie des Lépidoptères et des chenilles de l'Amérique Septentrionale, p. 128, pl. 37, figs. 1, 2, 3, 4, 5 (Paris).
Additional Reference: Kirby, W. F., 1871, A Synonymic Catalogue of Diurnal Lepidoptera, p. 345 (London). (Makes *crataegi* a synonym of *tarquinius* Fabricius.)

*crepundia* Druce, Hamilton H., *Thecla*
Type Locality: Río Colorado, Peru, 2,500 ft.
Location of Type: H. J. Adams Collection.
Original Description: 1909 (September), Trans. Ent. Soc. London, p. 435, pl. 11, fig. 6 ♂ (London).

*crethona* Hewitson, W. C., *Thecla*
Type Locality: Jamaica.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 157, vol. 2, pl. 62, figs. 420, 421 ♂ (London).

*crines* Druce, Hamilton H., *Thecla*
Type Locality: Río Minero, Muzo, Colombia, 2,500 ft. Bogotá, Colombia.
Location of Type: Godman Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 573, pl. 32, figs. 1 ♂, 2 ♀ (London).

*crispisulcans* Draudt, Max, *Thecla*
Type Locality: Santa Catharina, Brazil.
Location of Type:
Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 799, pl. 158-g (Stuttgart).

*critola* Hewitson, W. C., *Thecla*
Type Locality: Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1874, Ent. Mo. Mag., vol. 11, p. 105 (London).
Additional Reference: Hewitson, W. C. 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 197, vol. 2, pl. 78, figs. 633, 634 ♂ (London).

*croesioides* Scudder, Samuel H., *Incisalia augustus*
Type Locality: Eastern United States.
Location of Type:
Original Description: 1876 (April), Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 104 (Buffalo, N. Y.).
Additional References: McDunnough, J. H., 1938, Check list, pt. 1, p. 25, no. 403 (Los Angeles, Calif.). (Places *croesioides* as a synonym of *augustus* Kirby.) dos Passos, C. F., 1943 (June), Amer. Mus. Novitates, no. 1230, p. 2 (New York, N. Y.). (Places *croesioides* as a subspecies of *augustus* Kirby.)

*crolinus* Butler, A. G. and Herbert Druce, *Tmolus*
Type Locality: Cartago, Costa Rica.
Location of Type: British Museum (Natural History) (Druce Collection).
Original Description: 1872 (July), Cistula Entomologica, vol. 1, p. 107 (London).
Additional References: Butler, A. G., 1873 (October), Lepid. Exot., p. 160, pl. 57, fig. 13 (London). Godman, F. D. and O. Salvin, 1887 (August), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 63, vol. 3, pl. 55, figs. 31, 32 ♂, 33 ♀ type (London).

*crolus* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1780, Papillons exotiques des trois parties du monde, vol. 4, p. 85, pl. 333, figs. G, H (Amsterdam).
Additional Reference: Hewitson, W. C., 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 155 (London). (Determines *crolus* Cramer as a male of *echion* Linnaeus.)

*crossaea* Draudt, Max, *Thecla* (not Hewitson) See *crossoea* Hewitson
Type Locality:
Location of Type:
Original Description: 1920 (December), The Macrolepidoptera of the World, vol. 5, p. 809, pl. 159-1 (Stuttgart).

*crossi* Field, William D., *Callipsyche behrii*
Type Locality: Nederland, Colorado, July 19, 1936.
Location of Type: Collection William D. Field (United States National Museum?).
Original Description: 1938 (October), Jour. Kansas Ent. Soc., vol. 11, no. 4, p. 130 (McPherson, Kansas).

*crossoea* Hewitson, W. C., *Thecla*
Type Locality: ?
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 158, vol. 2, pl. 62, fig. 427 (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 95 (London). (Make *crossoea* a synonym of *mulucha* Hewitson.)
Synonyms: *crossaea* Draudt.

*cruenta* Gosse, Philip Henry, *Thecla*
Type Locality: Corrientes, Argentina, April.
Location of Type: British Museum (Natural History)?
Original Description: 1880 (September), Entomologist, vol. 13, p. 204, pl. 2, fig. 4 ♂ (London).

*crysalus* Edwards, William H., *Thecla*
Type Locality: Lake Paso, August 7, 1871.

Location of Type: Museum of Comparative Zoology.
Original Description: 1873 (March), Trans. Amer. Ent. Soc., vol. 4, p. 344 (Philadelphia, Pa.).
Synonyms: *chrysalus* Scudder.
Subspecies: *citima* Henry Edwards.

*culminicola* Staudinger, Otto, *Thecla?*
Type Locality: Huallatani, Bolivia, 4,000–4,500 meters.
Location of Type:
Original Description: 1894, Deutsche Ent. Zeit. (Iris), vol. 7, p. 80, pl. 2, fig. 6 (Dresden).

*cupa* Druce, Hamilton H., *Thecla*
Type Locality: Río Grande, Brazil.
Location of Type: Druce Collection.
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 612, pl. 36, fig. 12 ♂ (London).

*cupentus* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1781, Papillons exotiques des trois parties du monde, vol. 4, p. 93, pl. 337, figs. F, G ♂ (Amsterdam).
Synonyms: *annulatus* Gmelin.

*cuprea* Lathy, Percy I., *Thecla*
Type Locality: Macas, Ecuador.
Location of Type: Fournier Collection (Paris).
Original Description: 1930 (June), Trans. Ent. Soc. London, p. 134, pl. 9, fig. 6 (London).

*cupreus* Edwards, William H., *Chrysophanus*
Type Locality: Oregon (1 ♂, 1 ♀).
Location of Type:
Original Description: 1870 (January), Trans. Amer. Ent. Soc., vol. 3, p. 20 (Philadelphia, Pa.).
Synonyms: *maculinita* Gunder.

*curtira* Schaus, William, *Thecla*
Type Locality: Aroa, Venezuela.
Location of Type: United States National Museum, no. 5935 ♂.
Original Description: 1902, Proc. U. S. Natl. Mus., vol. 24, p. 413 (Washington, D. C.).
Additional Reference: Draudt, Max, 1920 (December), The Macrolepidoptera of the World, vol. 5, p. 811, pl. 145-g (Stuttgart). (Places *curtira* in the genus *Theclopsis.*)

*cuyamaca* Wright, W. S., *Miltoura spinetorum*
Type Locality: Julian, San Diego County, California, August 4, 1917.
Location of Type: W. S. Wright Collection.
Original Description: 1922 (October), Bull. So. Calif. Acad. Sci., vol. 21,

no. 2, p. 19, pls. C, D (Los Angeles, Calif.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 25, no. 396 (Los Angeles, Calif.). (Places *cuyamaca* as a synonym of *spinetorum* Hewitson.)

*cyanus* Draudt, Max, *Thecla*

Type Locality: Bolivia.

Location of Type:

Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 796, pl. 158-c (Stuttgart).

*cybele* Godman, F. D. and O. Salvin, *Thecla*

Type Locality: St. Vincent, B. W. I.

Location of Type: British Museum (Natural History).

Original Description: 1896, Proc. Zool. Soc. London, p. 516 (London).

Additional Reference: Draudt, Max, 1919, The Macrolepidoptera of the World, vol. 5, p. 748 (Stuttgart). (Makes *cybele* a subspecies of *marsyas* Linnaeus.)

*cybira* Hewitson, W. C., *Thecla*

Type Locality: Cuba and Jamaica.

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 161, vol. 2, pl. 63, figs. 435, 436 ♀ (London).

Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 81, pl. 1, fig. 15 (New York, N. Y.). (Make *cybira* a subspecies of *columella* Fabricius.)

*cycnus* Scudder, Samuel H., *Thecla* (not Edwards) Misspelling of *cygnus* Edw.

Type Locality:

Location of Type:

Original Description: 1876 (May), Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 109 (Buffalo, N. Y.).

*cyda* Godman, F. D. and O. Salvin, *Thecla*

Type Locality: Irazú, Costa Rica.

Location of Type: British Museum (Natural History).

Original Description: 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 28, vol. 3, pl. 51, figs. 15, 16 ♀ (London).

*cydia* Hewitson, W. C., *Thecla*

Type Locality: Rio de Janeiro.

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 160, vol. 2, pl. 63, figs. 433, 434 ♀ (London).

*cydonia* Druce, Hamilton H., *Thecla*

Type Locality: Interior of Colombia.

Location of Type: Druce Collection (♂).

Original Description: 1890, Ent. Mo. Mag., Series 2, vol. 1, p. 152 (London).

Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 583, pl. 33, fig. 14 ♂ type (London).

*cydrara* Hewitson, W. C., *Thecla*

Type Locality: Amazon.

Location of Type: British Museum (Natural History).

Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 17 (London).

Additional Reference: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 133, vol. 2, pl. 53, figs. 295, 296 ♂ (London).

*cygnus* Edwards, William H., *Thecla*

Type Locality: Nevada (♀).

Location of Type:

Original Description: 1871 (January), Trans. Amer. Ent. Soc., vol. 3, p. 207 (Philadelphia, Pa.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 24, no. 382 (Los Angeles, Calif.). (Places *cygnus* as a synonym of *californica* Edwards.)

Synonyms: *cycnus* Scudder.

*cyllarissus* Herbst, Johann Friedrich Wilhelm, *Papilio*

Type Locality:

Location of Type:

Original Description: 1800, Natursystem aller bekannten in und ausländischen Insekten, vol. 10, p. 297, pl. 291, figs. 3, 4 (Berlin).

Additional References: Kirby, W. F., 1877, A Synonymic Catalogue of Diurnal Lepidoptera, Supplement, p. 774, no. 162 (London). (Places *cyllarissus* in synonymy of *cyllarus* Cramer.) (Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 780 (Stuttgart). (Places *cyllarissus* in synonymy of *cyllarus* Cramer.)

*cyllarus* Cramer, Pierre, *Papilio*

Type Locality: Surinam.

Location of Type:

Original Description: 1775, Papillons exotiques des trois parties du monde, vol. 1, p. 43, pl. 27, figs. C, D (Amsterdam).

Synonyms: *cyllarissus* Herbst, *xanthica* Lathy.

Subspecies: *deliciae* Druce, *reducta* Lathy.

*cymon* Capronnier, J. B., *Thecla* Nomen nudum

Type Locality: Rio de Janeiro, Brazil.

Location of Type:

Original Description: 1874, Ann. Soc. Ent. Belgique, vol. 17, p. 14 (Bruxelles).

*cyna* Edwards, William H., *Lycaena*

Type Locality: San Antonio, Texas (♀).

Location of Type:
Original Description: 1881 (February), Trans. Amer. Ent. Soc., vol. 9, p. 3 (Philadelphia, Pa.).
Synonyms: *mela* Strecker.

*cynara* Godman, F. D. and O. Salvin, *Thecla*
Type Locality: Oaxaca, Mexico.
Location of Type: British Museum (Natural History).
Original Description: 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 19, vol. 3, pl. 49, figs. 9, 10 ♂, 11 ♀ (London).

*cyphara* Hewitson, W. C., *Thecla*
Type Locality: Panamá.
Location of Type: British Museum (Natural History).
Original Description: 1874, Ent. Mo. Mag., vol. 11, p. 106 (London).
Additional Reference: Hewitson, W. C., 1877, Illus. of Diurnal Lepidoptera, vol. 1, p. 186, vol. 2, pl. 74, figs. 579, 580 ♂ (London).

*cypria* Geyer, Carl, *Theritas*
Type Locality: Yucatán.
Location of Type:
Original Description: 1837, Zutrage zur Sammlung exotischer Schmettlinge, vol. 5, p. 36, figs. 945, 946 ♀ (Augsburg).
Subspecies: *paphia* Felder and Felder.

*cyrriana* Hewitson, W. C., *Thecla*
Type Locality: Peru.
Location of Type: British Museum (Natural History).
Original Description: 1874, Ent. Mo. Mag., vol. 11, p. 105 (London).
Additional Reference: Hewitson, W. C., 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 195, vol. 2, pl. 78, figs. 625, 626 ♂ (London). Peru.

*daedalus* Behr, Hermann, *Lycaena*
Type Locality: Alpine regions, headwaters Tuolumne River, California.
Location of Type:
Original Description: 1867, Proc. Calif. Acad. Nat. Sci., vol. 3, p. 280 (San Francisco, Calif.).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 455 (Los Angeles, Calif.). (Places *daedalus* Behr as an aberration of *icarioides* Boisduval.)

*damastus* Godart, Jean B., *Polyommatus*
Type Locality: Virginia.
Location of Type: Paris Museum.
Original Description: 1822, Encyclopédie Méthodique, vol. 9, p. 640 (Paris).
Note: Godart gave this new name for *Papilio damon* Cramer of which it is a synonym by reference.

*dammersi* Comstock, John A. and Christopher Henne, *Philotes enoptes*
Type Locality: Snow Creek, Riverside County, California.

Location of Type: Christopher Henne Collection (United States National Museum?). Paratype in American Museum of Natural History.

Original Description: 1933 (January-April), Bull. So. Calif. Acad. Sci., vol. 32, pt. 1, p. 24 (Los Angeles, Calif.), March.

*damo* Druce, Herbert, *Thecla*

Type Locality: Calobre, Panamá.

Location of Type: British Museum (Natural History).

Original Description: 1875 (May), Cistula Entomologica, vol. 1, p. 362 (London).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 15, vol. 3, pl. 49, figs. 1, 2 ♂, 3 ♀ (London).

Subspecies: *dorcas* Druce.

*damon* Cramer, Pierre, *Papilio*

Type Locality: Virginia, U. S. A.

Location of Type:

Original Description: 1784, Papilons exotiques des trios parties du monde, vol. 4, p. 208, pl. 390, figus. C, D (Amsterdam).

Synonyms: *aubumiana* Harris, *auburniana* Harris, *damastus* Godart, *gryneus* Hübner, *smilacis* Boisduval and LeConte, *patersonia* Brehme syn.

Subspecies: *castalis* Edwards, *brehmei* Barnes and Benjamin syn.

*danaus* Felder, Cajetan and Rudolf Felder, *Pseudolycaena*

Type Locality: Venezuela.

Location of Type:

Original Description: 1864–1867, Reise der Osterreichischen Fregatte "Novara" um die Erde, vol. 2, p. 248, pl. 31, figs. 6, 7 (Wien).

*daraba* Hewitson, W. C., *Thecla*

Type Locality: Amazon.

Location of Type: British Museum (Natural History).

Original Description: 1867, Illus. of Diurnal Lepidoptera, vol. 1, p. 105, vol. 2, pl. 36, fig. 89 ♂ (London).

Additional Reference: Hewitson, W. C., 1874 (December), *op. cit.*, vol. 1, p. 158, vol. 2, pl. 62, figs. 425, 426 ♂, 424 ♀. (Makes *daraba* a synonym of *yojoa*, which is incorrect; fig. 426 is a female not a male.)

*datitia* Jones, E. Dukinfield, *Thecla*

Type Locality: Fernandes Pinheiro, Paraná, Brazil.

Location of Type: Jones Collection.

Original Description: 1912, Proc. Zool. Soc. London, p. 901, pl. 97, fig. 15 (London).

*daunia* Edwards, William H., *Lycaena*

Type Locality: Colorado (♂).

Location of Type:

Original Description: 1871 (March), Trans. Amer. Ent. Soc., vol. 3, p. 272 (Philadelphia, Pa.).

Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 28, no. 472 (Los Angeles, Calif.). (Places *daunia* as a subspecies of *piasus* Boisduval.)

*davara* Hewitson, W. C., *Thecla*
Type Locality: None given.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 31 (London).
Additional Reference: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 147, vol. 2, pl. 58, fig. 371 (London).
Subspecies: *joannisi* Dufrane.

*davisi* Watson, Frank E. and William P. Comstock, *Incisalia polios* ab.
Type locality: Lakehurst, New Jersey, April 29 (Collector W. T. Davis).
Location of Type: American Museum of Natural History.
Original Description: 1920 (December), Bull. Amer. Mus. Nat. Hist., vol. 42, art. 10, p. 453 (New York, N. Y.).

*dealbata* Draudt, Max, *Thecla phydela* form
Type locality: Brazil.
Location of Type:
Original Description: 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 752, pl. 149-g (Stuttgart).

*debora* Geyer, Carl, *Eumaea*
Type locality:
Location of Type:
Original Description: 1834, Sammlung exotischer Schmetterlinge, vol. 3, pl. (18) (Augsburg).

*deborrei Capronnier*, J. B., *Thecla*
Type Locality: Botafogo, Brazil, November 27.
Location of Type:
Original Description: 1874, Ann. Soc. Ent. Belgique, vol. 17, p. 17, pl. 1, fig. 4 (Bruxelles).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 630 (London). (Makes *deborrei* (♀) a synonym of *faunalia* Hewitson).

*decorata* Lathy, Percy I., *Lamprospilus*
Type Locality: Oxapampa, Peru (1 ♂).
Location of Type: Fournier Collection, Paris.
Original Description: 1926, Ann. Mag. Nat. Hist., Series 9, vol. 17, p. 47 (London).
Additional Reference: Lathy, P. I., 1930 (June), Trans. Ent. Soc. London, pl. 9, fig. 17 ♂ (London.

*decyanea Lathy*, Percy I., *Lamprospilus azaria* ♀ ab.
Type Locality: Petropolis, Brazil (1 ♀).

Location of Type: Fournier Collection, Paris.

Original Description: 1932, Ann. Mag. Nat. Hist., Series 10, vol. 9, p. 182 (London).

*deidamia* Burmeister, H., *Thecla*

Type Locality: Las Conchas, north of Buenos Aires, Argentina.

Location of Type:

Original Description: 1879, Atlas Desc. Physique République Argentine, vol. 5, Lép., pt. 2, p. 24 (Buenos Aires).

Additional Reference: Clench, H. K., 1944 (July), Bull. Mus. Comp. Zool., vol. 94, p. 234 (Cambridge, Mass.). (Makes *deidamia* a synonym of *remus* Hewitson.)

*deliciae* Druce, Hamilton H., *Thecla*

Type Locality: Maranham, North Brazil.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 595, pl. 35, fig. 3 ♂ (London).

Additional Reference: Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 780, pl. 151–i (Stuttgart). (Makes *deliciae* a subspecies of *cyllarus* Cramer.)

*del sud* Wright, William Greenwood, *Chrysophanus*

Type Locality: San Diego, California.

Location of Type:

Original Description: 1906, Butterflies of the West Coast, 2nd edit., p. 215, pl. 28, figs. 347, 347-b ♀ (San Bernardino, Calif.).

Note: The date of the species is 1905, from 1st edition published by the Whitaker and Ray Co., San Francisco, California.

Additional Reference: Skinner, Henry, 1905 (December), Ent. News, vol. 16, p. 337 (Philadelphia, Pa.). (Makes *del sud* a synonym of *hermes* Edwards.)

*delus* Capronnier, J. B., *Thecla* Nomen nudum

Type Locality: Botafogo, Brazil.

Location of Type:

Original Description: 1874, Ann. Soc. Ent. Belgique, vol. 17, p. 17 (Bruxelles).

*demea* Hewitson, W. C., *Thecla*

Type Locality: Nicaragua (Chontales).

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 180, vol. 2, pl. 70, figs. 533, 534 ♂ (London).

Additional Reference: Godman, F. D. and O. Salvin, 1887 (October), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 100 (London). (Places *demea* in genus *Theclopsis*.)

*demilineata Lathy,* Percy I., *Thecla*

Type Locality: Paraguay.

Location of Type: Fournier Collection, Paris.

Original Description: 1936, Livre Jubilaire de M. Eugene-Louis Bouvier, p. 231, pl. 8, fig. 16 (Paris).

*demonassa* Hewiston, W. C., *Thecla*
Type Locality: Venezuela and Amazon.
Location of Type: British Museum (Natural History).
Original Description: 1868, Specimen of a Catalogue of Lycaenidae in the British Museum, p. 25 (London).
Additional Reference: Hewitson, W. C., 1873 (February), Illus. of Diurnal Lepidoptera, vol. 1, p. 148, vol. 2, pl. 58, figs. 376, 378 ♂, 377 ♀ (London).

*denarius* Butler, A. G. and Herbert Druce, *Tmolus*
Type Locality: Cartago, Costa Rica.
Location of Type: British Museum (Natural History).
Original Description: 1872 (July), Cistula Entomologica, vol. 1, p. 109 (London).
Additional Reference: Butler, A. G., 1873 (October), Lepid. Exot., p. 162, pl. 57, fig. 3, (London).
Synonyms: *calena* Hewitson, *renarius* Butler.

*deniva* Hewitson, W. C., *Thecla*
Type Locality: Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 180, vol. 2, pl. 71, figs. 535, 536 ♀ (London).

*derus* Capronnier, J. B., *Thecla* Nomen nudum
Type Locality: Botafogo, Brazil
Location of Type:
Original Description: 1874, Ann. Soc. Ent. Belgique, vol. 17, p. 18 (Bruxelles).

*desdemona* Hewitson, W. C., *Thecla*
Type Locality: Guatemala (Polochic Valley.)
Location of Type: British Museum (Natural History).
Original Description: 1867, Illus. of Diurnal Lepidoptera, vol. 1, p. 79, vol. 2, pl. 45, figs. 189, 190 ♂ (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (May), Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 30 (London). (Make *desdemona* a synonym of *barajo* Reakirt.)

*deserta* Draudt, Max, *Thecla syncellus* form
Type Locality: Guerrero, Mexico.
Location of Type:
Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 779, pl. 151-k (Stuttgart).
Additional Reference: Draudt, Max, 1921 (January), *op. cit.*, vol. 5, p. 823. (Said: "for *deserta* insert: *sierrae* Dyar.")
Note: Draudt means that *deserta* is a synonym of *sierrae*.

*desertorum* Grinnell, Fordyce, Jr., *Strymon sylvinus*
Type Locality: Oak Creek, Kern County, California, June 29, 1905.
Location of Type: American Museum of Natural History.
Original Description: 1917 (October), Can. Ent., vol. 49, p. 349 (London, Ontario).

*detesta* Clench, Harry K., *Thecla*
Type Locality: St. Fé de Bogotá, Colombia.
Location of Type: British Museum (Natural History).
Original Description: 1946 (July), Entomologist, vol. 79, p. 155 (London).

*deutargiolus* Scudder, Samuel H., *Cyaniris*
Type Locality:
Location of Type:
Original Description: 1876 (May), Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 115 (Buffalo, N. Y.)
Note: Scudder attributes this name to Harris, "MSS., Harr. Ent. Cor., 165 (Polyommatus)," and places it as a synonym of *neglecta* Edwards.

*devia* Möschler, H. B., *Thecla*
Type Locality: Surinam?
Location of Type:
Original Description: 1883, Verh. zool.-bot. Ges., vol. 32, p. 311, pl. 17, fig. 7 (Wien).
Additional Reference: Schaus, William, 1920, Ent. News, vol. 31, p. 176 (Philadelphia, Pa.). (Makes *devia* a synonym of *xeneta* Hewitson.)

*diaguita* Hayward, Kenneth J., *Thecla*
Type Locality: Villa Nogues, Tucumán, Argentina (1100 meters, January 12, 1931).
Location of Type: Fundación Miguel Lillo, Tucumán.
Original Description: 1949, Acta Zool. Lilloana, vol. 8, p. 576, pl., fig. 4 (Tucumán, Argentina).

*dicaea* Hewitson, W. C., *Thecla*
Type Locality:
Location of Type: British Museum (Natural History).
Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 179, vol. 2, pl. 70, figs. 531, 532 ♂ (London).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 1619 (London). (Give locality as Castro, Parana, Brazil.)
Synonyms: *farmina* Schaus.

*dicaeoides* Lathy, Percy I., *Thecla*
Type Locality: Paraguay (♀).
Location of Type: Fournier Collection, Paris.
Original Description: 1936, Livre jubilaire de M. Eugene-Louis Bouvier, p. 229, pl. 8, fig. 1 ♀ (Paris).

*dicina* Draudt, Max, *Thecla*
Type Locality: Colombia.

Location of Type:
Original Description: 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 803, pl. 159-b (Stuttgart).

*dickiei* Weeks, A. G., Jr., *Thecla*
Type Locality: Coroico, Bolivia, May, 1889.
Location of Type: Museum of Comparative Zoology.
Original Description: 1901, Ent. News, vol. 12, p. 266 (Philadelphia, Pa.).
Additional Reference: Weeks, A. G., Jr., 1905, Illus. of Diurnal Lepidoptera, p. 49, pl. 14, fig. 1 (Boston, Mass.).

*didymaon* Auct., *Thecla* See *dydimaon* Cramer
Type Locality:
Location of Type:
Original Description:

*dignota* Draudt, Max, *Thecla*
Type Locality: Bogotá, Colombia (1 ♂).
Location of Type: Fassl Collection. (Now in Naturhistorisches Museum, Basle.)
Original Description: 1919 (December), The Macrolepidoptera of the World, vol. 5, p. 754, pl. 153-b (Stuttgart).

*dindus* Fabricius, Johann Christian, *Hesperia*
Type Locality: "In India."
Location of Type: Lost (H. H. Druce).
Original Description: 1793, Entomologica Systematica, vol. 3, p. 269 (Hafniae).
Additional References: Butler, A. G., 1870, Catalogue of Diurnal Lepidoptera Described by Fabricius in the Collection of the British Museum, p. 189 (London). (Mentions Jones' figure as near *T. mulucha* Hewitson or *T. olbia* Hewitson.) Druce, H. H., 1907, Proc. Zool. Soc. London, p. 568 (London).

*dindymus* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1775, Papillons exotiques des trois parties du monde, vol. 1, p. 73, pl. 46, figs. F, G (Amsterdam).
Additional Reference: Hewitson, W. C., 1869 (April), Illus. of Diurnal Lepidoptera, vol. 1, p. 107, vol. 2, pl. 39, fig. 126 ♂ (London).
Synonyms: *sphinx* Fabricius.

*dinus* Hewitson, W. C., *Thecla*
Type Locality: Brazil.
Location of Type: British Museum (Natural History).
Original Description: 1867, Illus. of Diurnal Lepidoptera, vol. 1, p. 114, vol. 2, pl. 43, figs. 174, 175 ♀ (London).

*dion* Schallers, J. G., *Papilio* (*Plebejus Rurales*)
Type Locality: Unknown.
Location of Type:
Original Description: 1788, Der Naturforscher, vol. 23, p. 9 (Halle).
Note: Figure reference given as plate 1, figs. 9, 10.
Additional Reference: Draudt, Max, 1920 (February), The Macrolepidoptera of the World, vol. 5, p. 808 (Stuttgart. (Said "*dion* Schaller is a species not to be identified, perhaps allied to *faunalia.*")

*dione* Scudder, Samuel H., *Chrysophanus*
Type Locality: Dennison, Iowa, July; New Jefferson, Iowa, July 24.
Location of Type:
Original Description: 1868, Proc. Boston Soc. Nat. Hist., vol. 11, p. 401 (Boston, Mass.).
Additional Reference: Scudder, Samuel H., 1869, Trans. Chicago Acad. Sci., vol 1, p. 330 (Chicago, Illinois).
Subspecies: *gibboni* Gunder.

*discoidalis* Skinner, Henry, *Thecla damon* var.
Type Locality: Round Mountain, Blanco County, Texas, February 10 and August 16.
Location of Type: Academy of Natural Sciences, Philadelphia, Pennsylvania. (Paratype in American Museum of Natural History.)
Original Description: 1897 (June), Can. Ent., vol. 29, p. 156 (London, Ontario).
Additional Reference: McDonnough, J. H., 1938, Check list, pt. 1, p. 25 (Los Angeles, Calif.). (Places *discoidalis* as a synonym of *castalis* Edwards.)

*dissentanea* Draudt, Max, *Thecla*
Type Locality: Cuzco, Peru (2 ♂ ♂).
Location of Type: Fassl Collection (now in Naturhistorisches Museum, Basle).
Original Description: 1919 (December), The Macrolepidoptera of the World, vol. 5, p. 758, pl. 153-e (Stuttgart).
Additional Reference: Ureta R, Emiles, 1949, Boletin del Museo Nacional de Historia Natural, vol. 24, p. 97 (Santiago, Chile). (Gives description and figure of female.)

*distractus* Clench, Harry K., *Thecla amyntor*
Type Locality: Río Minero, Muzo Colombia, 2,500 ft.
Location of Type: British Museum (Natural History).
Original Description: 1946 (July), Entomologist, vol. 79, p. 153 (London).

*dodava* Hewitson, W. C., *Thecla*
Type Locality: Chiriquí, Panamá.
Location of Type: Staudinger Collection.
Original Description: 1877 (January), Illus. of Diurnal Lepidoptera, vol. 1, p. 200, vol. 2, pl. 79, figs. 647, 648 (London).
Additional Reference: Godman, F. D. and O. Salvin, 1887 (September),

Biologia Centrali-Americana, Insecta, Lepidoptera-Rhopalocera, vol. 2, p. 71, vol. 3, pl. 56, figs. 28, 29 ♂ (London).

*dodgei* Gunder, Jean D., *Everes amyntula* tr. f.
Type Locality: Santa Cruz, California, April 20, 1918.
Location of Type: American Museum of Natural History.
Original Description: 1927 (December), Can. Ent., vol. 59, p. 283, pl. A, fig. 7 (Orillia, Ontario).
Additional Reference: McDunnough, J. H., 1938, Check list, pt. 1, p. 27, no. 448 (Los Angeles, Calif.). (Places *dodgei* as an aberration of *amyntula* Boisduval.)

*dolichos* Hübner, Jacob, *Atlides*
Type Locality: Georgia.
Location of Type:
Original Description: 1823, Zuträge zur Sammlung exotischer Schmettlinge, vol. 2, p. 9, pl. (39), figs. 219, 220 (Augsburg).
Additional Reference: Kirby, W. F., 1871, A Synonymic Catalogue of Diurnal Lepidoptera, p. 383, (London). (Makes *dolichos* a synonym of *halesus* Cramer.)

*dolichus* Hübner, Jacob, *Atlides.* See *dolichos* Hübner Nomen nudum
Type locality:
Location of Type:
Original Description: 1819, Verzeichniss bekannter Schmettlinge, p. 80, no. 815 (Augsburg).

*dolium* Druce, Hamilton H., *Thecla*
Type Locality: Honduras.
Location of Type: British Museum (Natural History).
Original Description: 1907 (June), Proc. Zool. Soc. London, p. 619 (London).

*dolosa* Staudinger, Otto, *Thecla*
Type Locality: Puerto Cabello and Mérida, Venezuela.
Location of Type: Staudinger Collection.
Original Description: 1888, Exotische Tagfalter, vol. 1, p. 286, vol. 2, pl. 97, (Bayern).
Additional Reference: Druce, H. H., 1907 (June), Proc. Zool. Soc. London, p. 579 (London). (Makes *dolosa* a synonym of *spurius* Felder and Felder.)

*dolylas* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1777, Papillons exotiques des trois parties du monde, vol. 2, p. 22, pl. 111, figs. B, C (Amsterdam).
Subspecies: *pallida* Lathy.

*dominica* Möschler, Heinrich Benno, *Lycaena*
Type Locality: Jamaica, B. W. I.

Location of Type:

Original Description: 1886, Abhandl. Sencken-berg. Naturf. Gesselsch., vol. 14, p. 26, fig. 10 (Frankfurt).

Additional References: Kaye, W. J., 1931, Trans. Ent. Soc. London, vol. 79, p. 534, pl. 39, figs. 1, 4, 7 (London). Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 101 (New York, N. Y.). (Consider *dominica* a good species.)

*dominicana* Lathy, Percy I., *Thecla*

Type Locality: Dominica, B. W. I.

Location of Type: H. J Adams Collection, 15 males (type).

Original Description: 1904 (March), Proc. Zool. Soc. London, p. 452 (London).

Additional Reference: Comstock, W. P. and E. I. Huntington, 1943 (December), Ann. New York Acad. Sci., vol. 45, p. 76 (New York, N. Y.).

Synonyms: *otoheba* Dyar.

*dorcas* Kirby, William (Rev.), *Lycaena*

Type Locality: "Taken in Latitude 54 deg." (Cumberland-house?)

Location of Type:

Original Description: 1837, Fauna Boreali-Americana; Zoology, British America (by Dr. John Richardson), pt. 4, Insects (By Rev. William Kirby), p. 299, pl. 4, fig. 1 (Norwich, England).

Synonyms: *anthelle* Doubleday.

Subspecies: *claytoni* Brower, *dospassosi* McDunnough.

*dorcas* Druce, Hamilton H., *Thecla*

Type Locality: Vina, Northwest Peru, 5,500 ft.

Location of Type: Godman Collection.

Original Description: 1907 (June), Proc. Zool. Soc. London, p. 572 (London).

Additional Reference: Draudt, Max 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 748 (Stuttgart). (Makes *dorcas* a subspecies of *damo* Druce.)

*doryasa* Hewitson, W. C., *Thecla*

Type Locality: Amazon (Pará).

Location of Type: British Museum (Natural History).

Original Description: 1874 (December), Illus. of Diurnal Lepidoptera, vol. 1, p. 179, vol. 2, pl. 70, figs. 527, 528 ♂ (London).

Subspecies: *epidius* Godman and Salvin.

*dospassosi* McDunnough, J. H., *Lycaena dorcas* var.

Type Locality: Bathurst, New Brunswick, August 6, 1939.

Location of Type: Canadian National Collection Ottawa, no. 5290.

Original Description: 1940, Can. Ent., vol. 72, p. 130 (Guelph, Ontario).

*doudoroffi* dos Passos, Cyril F., *Incisalia*

Type Locality: Big Sur, Monterey County, California, June 9, 1939.

Location of Type: American Museum of Natural History.

Original Description: 1940 (August), Can. Ent., vol. 72, p. 168 (Guelph, Ontario).

Subspecies: *windi* Clench.

*dowi* Clench, Harry K., *Strymon angelia*

Type locality: Arthurs Town, Cat Island, Bahamas, July 15, 1935.

Location of Type: Museum of Comparative Zoology, no. 25,451.

Original Description: 1941 (March), Rev. Torreia, Univ. Havana, no. 7, p. 4 (Havana, Cuba).

*draudti* Lathy Percy I., *Thecla*

Type Locality: Colombia and Central America.

Location of Type: Fournier Collection, Paris.

Original Description: 1926, Ann. Mag. Nat. Hist., Series 9, vol. 17, p. 40 (London).

Additional Reference: Lathy, Percy I., 1930, Trans. Ent. Soc., London, pl. 9, fig. 10 ♂ (London).

*draudti* Lathy, Percy I., *Lamprospilus*

Type Locality: Río Aquatal, Colombia, November 1908, 1800 m. (1 ♂).

Location of Type: Fournier Collection, Paris.

Original Description: 1932, Ann. Mag. Nat. Hist., Series 10, vol. 9, p. 181 (London).

*drucei* Lathy, Percy I., *Thecla*

Type Locality: Santa Catherina, Brazil.

Location of Type: Fournier Collection, Paris.

Original Description: 1926, Ann. Mag. Nat. Hist., Series 9, vol. 17, p. 41 (London).

*dryope* Edwards, William H., *Thecla*

Type Locality: Plain County, Colorado (1 ♂).

Location of Type:

Original Description: 1870 (January), Trans. Amer. Ent. Soc., vol. 3, p. 19 (Philadelphia, Pa.).

Additional Reference: Edwards, William H., 1870 (November), Trans. Amer. Ent. Soc., vol. 3, p. 193 (Philadelphia, Pa.). (Describes the male.)

*dubiosa* Lathy, Percy I., *Thecla*

Type Locality: "Patria ignota." (1 ♀).

Location of Type: Fournier Collection, Paris.

Original Description: 1936, Livre jubilaire de M. Eugene-Louis Bouvier, p. 232, pl. 8, fig. 20 (Paris).

*ducalis* Westwood, John Obadiah, *Thecla*

Type Locality: Brazil.

Location of Type: British Museum (Natural History).

Original Description: 1852, Genera of Diurnal Lepidoptera, vol. 2, p. 483, pl. 77, fig. 1 (London). (Figure only.)

Additional Reference: Lathy, Percy I., 1930 (June), Trans. Ent. Soc. London, vol. 78, p. 133, pl. 9, figs. 3 ♂, 4 ♀ (London).

*dumą* Hewitson, W. C., *Thecla*
Type Locality: Bogotá.
Location of Type: Staudinger Collection.
Original Description: 1878 (November), Illus. of Diurnal Lepidoptera, vol. 1, p. 211, vol. 2, pl. 84, fig. 713 (London).

*dumenilii* Godart, Jean B., *Polyommatus*
Type Locality: Antilles?
Location of Type:
Original Description: 1822, Encyclopédie Méthodique, vol. 9, p. 677 (Paris).
Synonyms: *argiva* Hewitson, *obscura* Staudinger.

*dumetorum* Boisduval, Jean A., *Thecla*
Type Locality: California.
Location of Type: United States National Museum?
Original Description: 1852, Ann. Soc. Ent. France, Series 2, vol. 10, p. 291 (Paris).
Additional Reference: Oberthür, Charles, 1913 (October), Etudes de Lepidopterologie Comparee, fasc. 9, pt. 1, p. 40, pl. 236, fig. 1926 (Rennes).
Subspecies: *perplexa* Barnes and Benjamin.

*dydimąon* Cramer, Pierre, *Papilio*
Type Locality: Surinam.
Location of Type:
Original Description: 1777, Papillons exotiques des trois parties du monde, vol. 2, p. 59, pl. 134, fig. A (Amsterdam).
Synonyms: *didymaon* Auct.

*dysmenia* Draudt, Max, *Theorema*
Type Locality: Upper Río Negro, Colombia.
Location of Type: Fassl Collection. (Now in Naturhistoriches Museum, Basle.)
Original Description: 1919 (November), The Macrolepidoptera of the World, vol. 5, p. 745, pl. 153-a (Stuttgart).

[To be continued]

(*continued from page 162*)

Article V

3. . . . *At the expiration of his term of office the Secretary shall deliver to his successor all papers, books, and other records belonging to the Society.*

Article IX

1. The subscription price of the Journal (and), the price of single numbers (to active members), (and discounts allowed to subscription agencies and on sales) *and the price* of sets shall be determined by the Executive Committee.

Article X

6. Whenever notice of any meeting is required by these by-laws it shall be deemed sufficient if published in the Bulletin of the New York Academy of Sciences *or the Calendar of the American Museum of Natural History. . . .*

(*continued on page 222*)

# CHANGES IN THE FAT CONTENT DURING METAMORPHOSIS OF THE MEALWORM, TENEBRIO MOLITOR LINNAEUS[1]

BY MARIUS R. MORAN
DEPARTMENT OF BIOLOGY, FORDHAM UNIVERSITY[2]

In the physiological studies of insects, the role of fats is of great importance. In many instances, fats have been claimed as a source of energy during metamorphosis due to its decrease throughout this period. This has been shown by Rudolfs (1932) with the tent caterpillar, *Malacosoma americana;* Becker (1934) with the mealworm, *Tenebrio molitor* and by Hitchcock and Haub (1941) with the blowfly, *Phormia regina.* However, Ludwig and Rothstein (1949) working with the Japanese beetle, *Popillia japonica* and Rousell (1955) with the mealworm, *T. molitor* have shown that glycogen is utilized during metamorphosis and may serve as a source of energy. Ludwig and Rothstein (1949) also believed that the supply of glycogen may be replenished at the expense of lipids. Because of the importance of fat either for oxidation or as a source of glycogen which may in turn be used as an energy source, an understanding of the energetics of metamorphosis require observations of the fate of fats at each day of this process.

## MATERIAL AND METHODS

Cultures were maintained at room temperature (approximately 25° C.) in chick growing mash. Water was provided by wetting the cloth covers of the cultures weekly. Mature larvae and prepupae were weighed and vacuum desiccated over anhydrous $CaCl_2$. Prepupae were also collected and placed in an incubator maintained at 30° C. Upon pupation the insects were placed in dated beakers and kept at 30° C. In this manner, pupae timed to within 24 hours, were obtained. At the desired stage of

[1] From a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Fordham University. The author wishes to express sincerest gratitude for the stimulation, interest and critical guidance of Dr. Daniel Ludwig.

[2] Author's address: 35 Ridgewood Ave., Glen Ridge, N. J.

metamorphosis, they were weighed and vacuum desiccated. All material was kept in desiccators until ready for use.

Free lipid determinations were made by filtered anhydrous ether and bound lipids by ether-alcohol (3 parts of 95 per cent ethyl alcohol to 1 part of anhydrous ethyl ether) extractions on the same insect in a Soxhlet apparatus. Extractions were continued for a minimum of seven and one-half hours and at the end of this period, the solvent was carefully poured from the Soxhlet flask into a beaker desiccated to a constant weight. The solvent was allowed to evaporate and the beaker was then dried to constant weight under vacuum desiccation. The difference between the final weight of the beaker with fat, and its initial weight without fat, represents the milligrams of free or bound lipid extracted.

## OBSERVATIONS

Table I shows the free, bound and total lipid content of the insect at different stages of metamorphosis. Each value is ex-

TABLE I

PER CENT OF FREE LIPIDS, BOUND LIPIDS AND TOTAL LIPIDS DURING THE STAGES OF METAMORPHOSIS OF THE MEALWORM. EACH VALUE IS EXPRESSED AS PER CENT WET WEIGHT.

| Stage | No. of Readings | Free Lipid | Bound Lipid | Total Lipid |
|---|---|---|---|---|
| Larva | 10 | 12.59 | 4.76 | 17.35 |
| Prepupa | 10 | 10.68 | 4.73 | 15.41 |
| Newly molted pupa | 20 | 10.20 | 5.40 | 15.60 |
| 1-day pupa | 20 | 10.46 | 4.46 | 14.92 |
| 2-day pupa | 10 | 9.05 | 4.19 | 13.24 |
| 3-day pupa | 10 | 8.35 | 3.91 | 12.26 |
| 4-day pupa | 10 | 7.87 | 3.47 | 11.34 |
| 5-day pupa | 10 | 8.22 | 5.08 | 13.30 |
| Newly emerged adult | 10 | 7.84 | 5.03 | 12.87 |

pressed as per cent wet weight. Free lipid decreased irregularly from 12.95 in the larva to 7.84 per cent in the newly emerged adult. On the other hand, bound lipid showed no consistent shifts but remained relatively constant throughout metamorphosis. These changes are shown graphically in figure 1.

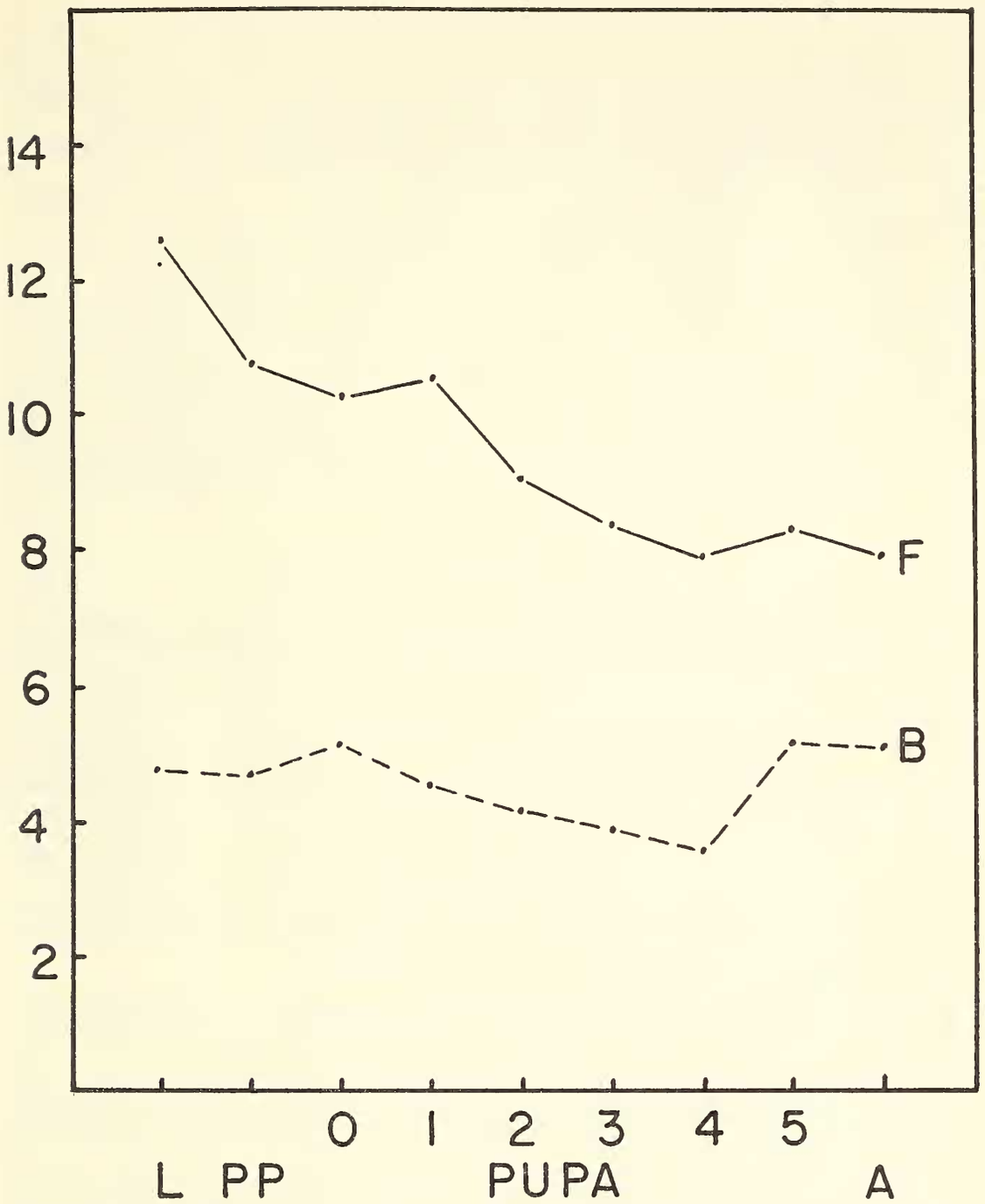


FIG. 1. Changes in the content of free lipid and bound lipid during the metamorphosis of the mealworm at 30° C. F denotes free lipid and B denotes bound lipid. L, larva; PP, prepupa; 0, newly molted pupa; 1 through 5 represents days of the pupal stage; A, newly emerged adult.

## DISCUSSION

The decrease in free lipids during metamorphosis may be due to their utilization as an energy source. Battista (1954), working with the Japanese beetle, *P. japonica,* showed a marked decrease in the fatty acid content during the fifth and sixth days of the pupal stage. This decrease coincided with an increase in

glycogen at 25° C reported by Ludwig and Rothstein (1949) for this species. They showed that the free fat content also decreased sharply on the fifth and sixth days. They believed that this increase in the glycogen content occurs at the expense of the fats. Rousell (1955) working with *T. molitor* demonstrated an increase in the glycogen content during the early days of metamorphosis after which it decreased steadily throughout the remainder of the life cycle. He claimed that energy may be stored in the form of glycogen built up during the larval period from stored fats and later used as an energy source during metamorphosis. Hence, in the mealworm the energy required for metamorphosis is obtained from the utilization of both fats and glycogen.

## SUMMARY

Lipid determinations were made on the mealworm, *Tenebrio molitor,* collected at 24 hour intervals during metamorphosis at 30° C.

Free lipids decreased irregularly while bound lipids remained relatively constant. Thus, free fats may be used as an energy source.

### Literature cited

BATTISTA, G. W. 1954. Changes in the fat content of the Japanese beetle (*Popillia japonica* Newman) during metamorphosis. Jour. N. Y. Ent. Soc. **62**: 27–37.

BECKER, M. 1934. Wandlungen des Fettes während der Metamorphose. Biochem. Zeitsch. **272**: 227–234.

HITCHCOCK, F. A. AND J. G. HAUB. 1941. The interconversion of foodstuffs in the blowfly (*Phormia regina*) during metamorphosis. Ann. Ent. Soc. America. **34**: 32–37.

LUDWIG, D. AND F. ROTHSTEIN. 1949. Changes in the carbohydrate and fat content of the Japanese beetle, *Popillia japonica* Newman, during metamorphosis. Physiol. Zoöl. **22**: 308–317.

ROUSELL, P. G. 1955. Determination of glycogen content during the metamorphosis of the mealworm (*Tenebrio molitor* Linnaeus). Jour. N. Y. Ent. Soc. **63**: 107–110.

RUDOLFS, W. 1932. Studies on chemical changes during the life cycle of the tent caterpillar (*Malacosoma americana* Fab.). Jour. N. Y. Ent. Soc. **40 (4)**; 481–488.

# CHANGES IN THE DISTRIBUTION OF NITROGEN DURING METAMORPHOSIS OF THE MEALWORM, TENEBRIO MOLITOR LINNAEUS[1]

By Marius R. Moran
Department of Biology, Fordham University[2]

Needham (1929) stated that during insect metamorphosis when larval tissues are histolyzed there should be a breakdown of the insoluble protein with a simultaneous increase in the soluble protein fractions. As the adult tissues are formed this process should be reversed. This hypothesis was verified by Evans (1932) with the sheep blowfly, *Lucilia sericata;* Anderson (1948) with the Japanese beetle *Popillia japonica;* and by Del Vecchio (1955) with the housefly, *Musca domestica.* However, Evans (1934) found no changes in the various nitrogen fractions during the metamorphosis of the mealworm, *Tenebrio molitor.*

Since this insect is also holometabolic, it seemed improbable that there would be no major changes in the nitrogenous fractions during its metamorphosis. The present study is a reinvestigation of the distribution of nitrogen during each day of metamorphosis in the mealworm, *T. molitor* at 30° C.

## MATERIAL AND METHODS

Cultures were maintained at room temperature (approximately 25° C.) in chick growing mash. Water was provided by wetting the cloth covers of the cultures weekly. Mature larvae and prepupae were weighed and vacuum desiccated over anhydrous $CaCl_2$. Prepupae were also collected and placed in an incubator maintained at 30° C. Upon pupation the insects were placed in dated beakers and kept at 30° C. In this manner pupae, timed to within 24 hours, were obtained. At the desired stage of metamorphosis, they were weighed and vacuum desiccated. All material was kept in desiccators until ready for use.

[1] From a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Fordham University. The author wishes to express sincerest gratitude for the stimulation, interest and critical guidance of Dr. Daniel Ludwig.

[2] Author's address: 35 Ridgewood Ave., Glen Ridge, N. J.

Fractionation was accomplished by the technique of Del Vecchio (1955). Each insect was pulverized and thoroughly mixed with 10 ml. of distilled water. To the supernate were added 1 ml. of $\frac{2}{3}$ N $H_2SO_4$ and 1 ml. of 10 per cent sodium tungstate to separate fraction B (water soluble protein not precipitated by tungstic acid) from fraction C (water soluble protein precipitated by tungstic acid). The residue remaining after the previous extractions was treated with a solution of ether-alcohol (1 ml. of distilled water, 4.5 ml. of absolute ethyl alcohol and 4.5 ml. of absolute ethyl ether) to remove fraction A (lipid nitrogen) from fraction D (water insoluble nitrogen). These fractions are given letters of designation so as to correspond with similar fractions obtained by Ludwig and Rothstein (1952) and Del Vecchio (1955). The Kjeldahl procedure was employed to make the nitrogen determinations on each fraction.

## OBSERVATIONS

No loss in the percentage of nitrogen occurred during the change from larva to adult. However, there was an increase in the total nitrogen percentage of the adult.

The changes in the distribution of nitrogen for each day of metamorphosis are given in table I. Each fraction is expressed

TABLE I

CHANGES IN THE DISTRIBUTION OF NITROGEN DURING THE METAMORPHOSIS OF THE MEALWORM. NITROGEN VALUES ARE GIVEN AS PER CENT TOTAL NITROGEN WITH THEIR STANDARD ERRORS.

| | Fraction A | Fraction B | Fraction C | Fraction D |
|---|---|---|---|---|
| Larva | 1.82 ± 0.23 | 13.41 ± 2.08 | 17.18 ± 1.75 | 67.59 ± 1.3 |
| Prepupa | 1.92 ± 0.12 | 11.57 ± 0.80 | 10.60 ± 0.63 | 75.96 ± 1.0 |
| Newly molted pupa | 2.97 ± 0.19 | 15.75 ± 0.41 | 12.85 ± 0.37 | 68.52 ± 0.52 |
| 1-day pupa | 2.15 ± 0.13 | 15.28 ± 0.86 | 12.06 ± 0.43 | 70.54 ± 0.74 |
| 2-day pupa | 2.00 ± 0.11 | 13.98 ± 0.51 | 11.33 ± 0.38 | 72.77 ± 0.87 |
| 3-day pupa | 1.98 ± 0.11 | 15.74 ± 0.80 | 12.31 ± 0.59 | 70.04 ± 0.91 |
| 4-day pupa | 1.65 ± 0.12 | 14.80 ± 0.80 | 11.66 ± 0.64 | 72.21 ± 0.90 |
| 5-day pupa | 1.32 ± 0.33 | 16.14 ± 0.79 | 11.36 ± 0.31 | 70.73 ± 0.77 |
| Newly emerged adult | 1.40 ± 0.11 | 18.64 ± 0.46 | 11.91 ± 0.68 | 68.04 ± 0.77 |

as per cent total nitrogen. Fraction A (lipid nitrogen) remained constant during the larval and prepupal stages and then increased to 2.97 per cent in the newly molted pupa. This increase was followed by a decrease to 2.15 in the 1-day pupa and then a steady decrease to 1.40 per cent in the newly emerged adult. Fraction B decreased from 13.41 in the larva to 11.57 per cent in the prepupa. This decrease was followed by an increase to approximately 15 per cent in the early pupa and it remained at approximately this value until the last day of the pupal stage. Upon emergence it increased to 18.64 per cent. Fraction C decreased from a high of 17.18 per cent in the larval stage to 10.60 in the prepupal stage. This fraction remained between 11 and 13 per cent throughout the remainder of the life cycle. Fraction D was 67.59 per cent in the larva and increased to 75.96 in the prepupa. This increase was followed by a decrease to 68.52 per cent in the newly molted pupa. This fraction then increased to 70.54 per cent in the 1-day pupa and remained at approximately this value throughout the remainder of the pupal stages. Upon emergence of the adult it decreased to 68.04 per cent. These changes are shown graphically in figure 1. Fraction D (insoluble nitrogen) showed a marked decrease in the newly molted pupa and then gradually increased until the 2-day pupa. The graph shows that nitrogen from fraction D is transferred to A, B and C in the newly molted pupa. Reciprocal shifts are shown between fractions D and B. All of these shifts were shown to be statistically significant.

## DISCUSSION

The constancy of the nitrogen percentages are in agreement with those of other workers (Evans 1932, for the blowfly, *Lucilia sericata,* Anderson 1948, for the Japanese beetle, *Popillia japonica,* and Del Vecchio 1955, for the housefly, *Musca domestica*). The increase in the percentage of total nitrogen obtained upon emergence of the adult may be associated with the shedding of the cuticle and a loss of water which occurs at this time. The results of the present study on the distribution of nitrogen are in accordance with other work on holometabolous insects. The shifts in nitrogen obtained during the metamorphosis from prepupa to pupa indicate a breakdown of larval protein and an increase in the decomposition products. During the early pupal

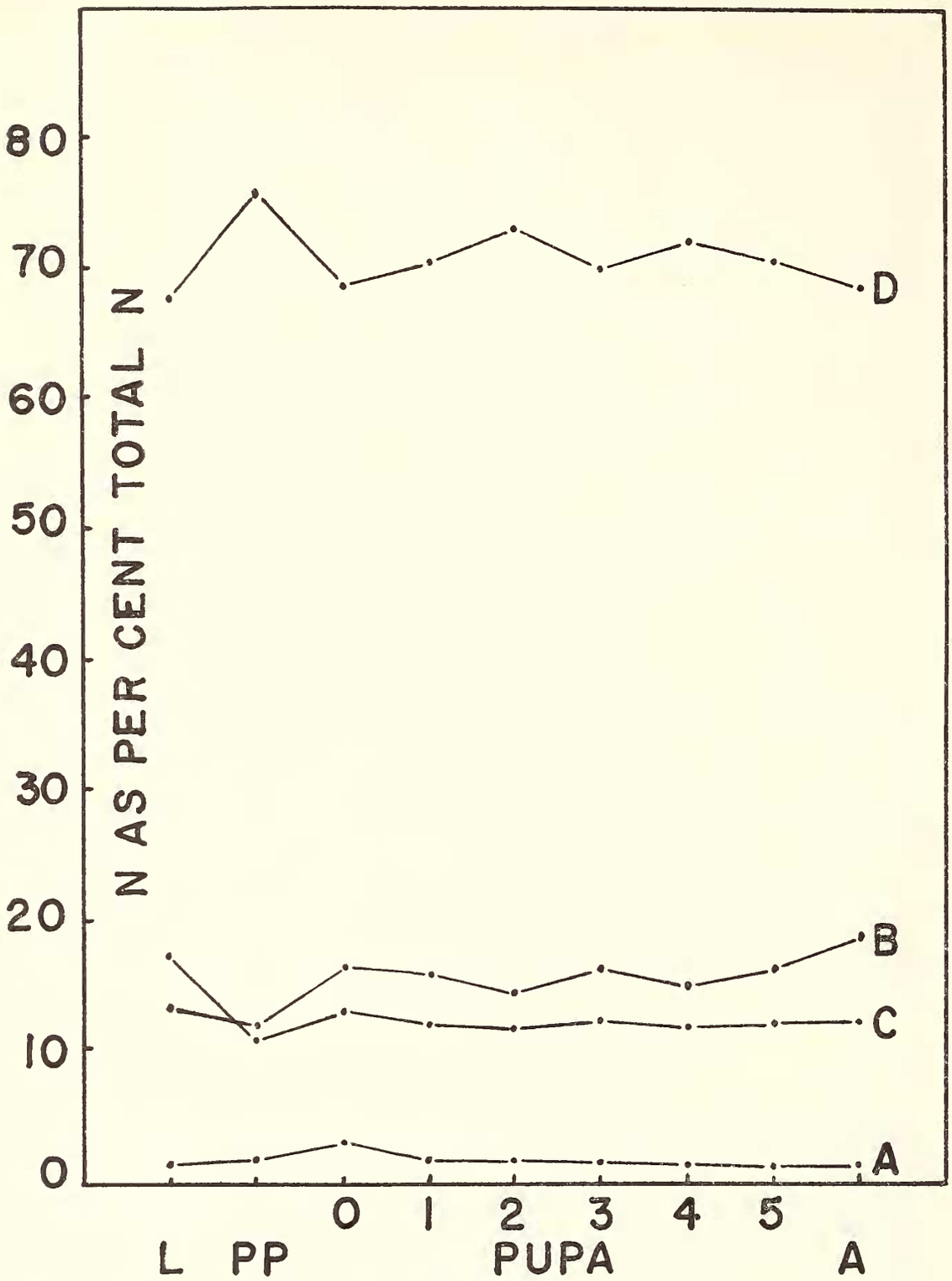


FIG. 1. Changes in the per cent of total nitrogen of the various fractions during the metamorphosis of the mealworm at 30° C. L, larva; PP, prepupa; O, newly molted pupa; 1 through 5 represent days of the pupal stage; A, newly emerged adult.

stages there is an utilization of these products for the synthesis of adult tissues. If the processes of histolysis and histogenesis occur simultaneously during the change from the prepupa to newly molted pupa, the process of histolysis is dominant while

the process of histogenesis is dominant during the early pupal stages. Evans (1934) studied the distribution of nitrogen in the mealworm, *T. molitor* on alternate days during metamorphosis at 25° C. from larva to adult. He obtained the insoluble protein fraction by the addition of distilled water to the powered material. Soluble proteins were precipitated by the addition of trichloroacetic acid to the filtrate, while proteoses and peptones were precipitated with sulphuric acid and sodium tungstate. He failed to show any major shifts and concluded that histolysis and histogenesis are not as clearly defined in Coleoptera as in the higher Diptera. The work of Anderson (1948) on the Japanese beetle has shown the inaccuracy of this generalization since a large decrease in the insoluble and an increase in the soluble nitrogen occurred at pupation. In the present study, complimentary shifts between the nitrogenous fractions were obtained also during the transition from prepupa to pupa but were not as pronounced as those found by Anderson (1948) for the Japanese beetle or by Del Vecchio (1955) for the housefly.

## SUMMARY

Nitrogen fractionations were made on the mealworm, *Tenebrio molitor,* collected at 24 hour intervals during metamorphosis at 30° C.

The change from larva to adult showed no loss in the percentage of nitrogen but a slight increase occurred upon the emergence of the adult.

During metamorphosis the insoluble proteins (fraction D) decreased sharply from 76.0 in the prepupa to 68.5 in the newly molted pupa. It then increased to 72.8 per cent in the 2-day pupa and remained at approximately this value during the remainder of the pupal stage. Upon emergence of the adult it decreased to 68.04 per cent. Reciprocal shifts are shown in fraction B. Nitrogen from fraction D was transferred to A, B and C in the newly molted pupa.

The complimentary shifts between the nitrogenous fractions may indicate the breakdown of the larval protein during the transition from prepupa to pupa and the synthesis of adult protein during the remainder of the pupal period. However, these shifts were not as pronounced in this species as in some other holometabolous insects.

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(*continued from page 212*)

Mr. Farb proposed that Mr. Tony Roberts be appointed to report to the Executive Committee on the possibilities of forming a Junior Entomological Society under the sponsorship of the Society. A substitute motion was made and passed that Miss Alice Gray and Mr. Roberts be invited to the December 3rd meeting of the Executive Committee to report on possibilities of such a move.

Dr. M. J. Ramsey, Training Officer of the Plant Quarantine Division, U. S. Department of Agriculture spoke on "Insects In International Commerce." He reported that 5000 years ago the granary weevil was found in the tombs of the Pharoahs and was probably the first insect transported around the known world in commerce. In the recent book *Faunal Connections Between Europe and North America*, Lindroth delves into the records of early explorers of the New World and concludes that since their ballast was soil, many insects were carried with them. And the second voyage of Columbus might very well have been the means of bringing European insects to this country, since he was carrying plants to propagate in the New World.

It is in cargo shipments that we today find the bulk of insects entering international commerce, said Dr. Ramsey. The mails, too, can be a means of dissemination; for example, USDA recently found the Khapra beetle in rice seeds mailed from Asia. One of plant quarantine's major problems is shamrocks sent from Ireland, since golden nematode cysts are often found in the soil accompanying them. The increase in international air travel increases the problem of quarantine, since serious pests can survive the short flights.

Of our present pests, records kept between 1854 and 1904, before there was a federal quarantine, show that 100 pests of agriculture became established here from abroad. Since then, there have been very few. To show the magnitude of the job in keeping foreign injurious insects from our borders, Dr. Ramsey said that the yearly average for the last decade has been the interception of 6763 shipments that contained pests not yet established in this country.

(*continued on page 235*)

# UNDESCRIBED SPECIES OF CRANE-FLIES FROM THE HIMALAYA MOUNTAINS (TIPULIDAE, DIPTERA), IV*

By Charles P. Alexander
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The preceding part under this general title was published in the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY, **66**: 161–170. As was the case with the preceding three instalments, materials discussed at this time are from Nepal where they were taken in 1957 by Dr. Edward I. Coher and assistants. A single species from the Darjeeling District, north India, taken by Father Aloysius Camilleri, is included. All types are included in the author's collection of crane-flies.

**Tipula (Vestiplex) bhutia** new species

Belongs to the *himalayensis* group; mesonotum gray, the praescutum with four brownish gray stripes that are narrowly bordered by blackish, the interspaces narrow; antennae relatively long, basal three segments yellow, the remainder black, first flagellar segment short; legs black, only the femoral bases yellow, claws of male toothed; wings conspicuously marbled brown and creamy yellow; abdomen yellow basally, the outer five segments black; male hypopygium with the tergal lobes broadly rounded; apex of basistyle terminating in two short black teeth or spines; outer dististyle darkened; appendage of ninth sternite simple, relatively short, from an enlarged base; aedeagus stout, narrowed to an acute point.

MALE. Length about 13 mm.; wing 15 mm.; antenna about 5 mm.

Frontal prolongation of head gray, nasus elongate, yellowed at tip; palpi black. Antennae of male relatively long; scape and pedicel brownish yellow, first flagellar segment a little darker, remainder of organ black; first flagellar segment short, only slightly more than one-half the second; outer segments somewhat incised, longer than the verticils. Head gray on the anterior vertex, with a capillary brown central vitta extending from the small vertical tubercle backward; posterior half of head, including the genae, more fulvous.

Pronotum dark gray, vaguely patterned with darker. Mesonotal praescutum with the very restricted ground gray, with four dark brownish gray stripes that are narrowly bordered by blackish, the interspaces narrowly obscured; scutal lobes each with two dark gray areas that are narrowly bordered by darker, central area brownish yellow; scutellum gray, with a

* Contribution from the Entomological Laboratory, University of Massachusetts.

brown central line; mediotergite yellow pollinose, darker on sides and behind, with indications of a capillary darkened vitta, pleurotergite yellow. Pleura chiefly gray, more or less variegated with darker; dorsopleural region brown, metapleura yellow. Halteres with stem yellow, knob dark brown. Legs with fore coxae gray, remaining coxae somewhat more buffy; trochanters yellow; femora black, the bases yellow, narrowly so on the posterior legs; no yellow subterminal ring as is common in the group; tibiae and tarsi black; claws of male with a small basal tooth. Wings brown, conspicuously marbled with cream yellow areas, the ground more extensive than the pale areas, the latter in all cells before cord, including two or more areas each in cells *R*, *M*, *Cu* and the Anals; beyond the cord the yellow is chiefly restricted to a short poststigmal band extending from costa into cell $R_5$; a small slightly more whitened area across base of cell *1st* $M_2$, including also small parts of cells *R* and $M_3$; prearcular field conspicuously yellowed, costal region more obscurely so; veins brown, yellow in the brightened fields, including the outer radial cells. Venation: $R_{1+2}$ strongly upcurved; petiole of cell $M_1$ subequal to or shorter than the oblique *m*; *m-cu* at fork of $M_{3+4}$ or beyond this on vein $M_4$.

Abdomen with the basal sternites yellow, the tergites with three narrow stripes, the median one paler; fifth and succeeding segments, including the hypopygium, brownish black. Male hypopygium with the tergite transverse, narrowed outwardly, the posterior border with a narrow V-shaped median notch forming broad rounded lobes that are provided with abundant relatively short setae except on the lateral parts; tergite apparently without further ventral armature, as in several allied species. Outer margin of basistyle at apex produced into a short stout black spine, in cases with a second similar spine or point. Appendage of ninth sternite a short relatively stout rod from an enlarged darkened base, the latter with strong setae from conspicuous pale punctures; outer rod very gently curved, narrowed to an acute spine, surface with strong setae. Outer dististyle an elongated darkened club with strong retrorse setae at outer end; inner style with beak relatively stout, slightly upcurved, apex obtuse; lower beak and other lobes blackened. Aedeagus stout, narrowed to an acute point, with distinct lateral shoulders.

Holotype, ♂, Simbhanjang Pass, Nepal, 8650 feet, April 16, 1957 (Coher). Paratopotypes, 2 ♂♂, with the type.

While generally similar to various other Himalayan members of the group in its conspicuously marbled wings and appearance, the present fly differs from all in the coloration, structure of the antennae and particularly in features of the male hypopygium, including the tergite, basistyle, dististyles and appendage of the ninth sternite. The lack of a yellow subterminal ring on the femora is noteworthy.

**Tipula (Vestiplex) malla** new species

Belongs to the *himalayensis* group; size relatively large (wing of male

16 mm.); mesonotal praescutum with four brownish gray stripes; scutellum and mediotergite with a central brown vitta; antennae relatively long, basal flagellar segments bicolored; legs black, femoral bases and a narrow subterminal ring yellowed; wings marbled light brown and creamy yellow; $R_{1+2}$ preserved; basal abdominal segments yellow, the lateral tergal borders narrowly gray, outer segments more uniformly blackened; male hypopygium with the posterior border of tergite produced into two broad blackened lobes, their margins obliquely truncated and microscopically roughened; inner dististyle with the beak long and slender; appendage of ninth sternite a gently curved simple rod from an expanded base, its tip acute.

MALE. Length about 16 mm.; wing 16 mm.; antenna about 5 mm.

Frontal prolongation of head brownish yellow; nasus distinct, relatively stout; palpi black. Antennae of male relatively long; scape and pedicel yellow, first flagellar segment obscure yellow, the central half swollen and slightly darker; succeeding two or three segments bicolored, the small basal enlargements black, the remainder brownish yellow, passing through brown to black, the segments beyond midlength of the organ almost uniformly darkened; segments feebly incised, much longer than the verticils. Head brownish yellow, the orbits more pruinose; a narrow darkened central stripe on vertex, beginning on the entire vertical tubercle.

Pronotum brownish gray, the scutum with three blackened areas, scutellum more yellowed. Mesonotal praescutum with the restricted ground brownish yellow, with four brownish gray stripes, the lateral pair slightly darker, especially on their inner border; median interspace very narrow and more obscured than the lateral ones; intermediate stripes confluent on extreme anterior ends and here with very restricted darkened borders; scutum grayish yellow; stigma small, pale brown; yellow areas before cord subequal in mediotergite grayish yellow with a clearly defined brown central vitta; pleurotergite more yellowed. Pleura gray, slightly patterned with darker; dorsopleural membrane dusky. Halteres with stem yellow, knob brownish black. Legs with fore coxae gray, remaining coxae more yellowed; trochanters yellow; femora black, bases restrictedly yellowed, with a narrow obscure brownish yellow subterminal ring, the blackened tips more extensive; tibiae and tarsi black; claws small, simple. Wings light brown, conspicuously marbled with pale creamy yellow areas; prearcular field and cell *Sc* deeper yellow; stigma small, pale brown; yellow areas before cord subequal in extent to the dark pattern, most extensive in cells *R* and *M* where they form a major V-shaped mark; cell *Cu*, base and angles of *1st A*, and much of cell *2nd A* yellowed; beyond the cord the yellow color appears chiefly as an incomplete poststigmal band extending from costa into the base of cell $R_5$; a single isolated whitish yellow area in cell *1st* $M_2$ and bases of cells $M_3$ and $M_4$; veins of anterior half of wing yellowed, of posterior half, from *M* backward, darker. Venation: $R_{1+2}$ preserved, upcurved at tip, widening the cell; *Rs* moderately long, about one-half longer than *m-cu;* cell $M_1$ about three times its petiole; cell *1st* $M_2$ pointed at its inner end; *m-cu* shortly before the fork of $M_{3+4}$.

Basal abdominal segments yellow, the lateral tergal borders narrowly

gray, margined internally by a vague darker line, more evident on cephalic part of the individual segments; outer end of abdomen more uniformly blackened ; styli yellowed. Male hypopygium with the tergite small, transverse, its posterior border produced into two broad blackened lobes that are separated by a very narrow notch; lobes blackened, their margins obliquely truncated and microscopically serrulated or roughened, the inner angle produced into a more definite tooth; immediately beneath the dorsal lobes is a second one, its surface with numerous microscopic spicules. Basistyle without blackened armature, the outer apical part produced into a weak pale triangular blade. Appendage of ninth sternite a gently curved rod from an expanded base, relatively short, its tip acute; surface with long pale setae that are more abundant at base. Two dististyles, the outer elongate, narrow, entirely pale, its inner face provided with abundant very long erect to slightly retrorse setae; inner style with the beak long and slender, its lower margin heavily blackened, provided with short setae; outer basal lobe relatively large. Phallosome broad at base, the outer third more narrowed but without a distinct shoulder. Eighth sternite relatively large, posterior border convexly rounded, with relatively few setae.

Holotype, ♂, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher).

Allied and generally similar to other species of the *himalayensis* group, such as *Tipula* (*Vestiplex*) *distifurca* Alexander, *T.* (*V.*)*subtincta* Brunetti, and others, differing especially in the structure of the male hypopygium, particularly the tergite, appendage of the ninth sternite, and the dististyles.

**Tipula (Vestiplex) rana** new species

Belongs to the *himalayensis* group; size relatively large (wing of male 16 mm.); general coloration of praescutum yellow with four entire brown stripes; antennae relatively long, scape and pedicel yellow, flagellum brown; femora black with a broad brownish yellow subterminal ring; claws of male toothed; wings variegated yellow and pale brown; $R_{1+2}$ entire; basal abdominal segments yellow, tergites with three black stripes, outer four segments brownish black; male hypopygium with the posterior border of tergite four-lobed; inner dististyle broad; appendage of ninth sternite broad at base, narrowed into a slender spine, surface with unusually long pale setae.

MALE. Length about 15 mm.; wing 16 mm.; antenna about 4.3 mm.

Frontal prolongation of head about equal in length to the remainder, light brown, restrictedly gray pruinose at base above; nasus slender; basal segment of palpi brownish yellow, remainder black. Antennae of male relatively long; scape and pedicel yellow, first flagellar segment light brown, the remainder dark brown; segments feebly incised, longer than the verticils. Head above yellow medially, brightest in front, chestnut brown on orbits and genae; vertex with a more darkened central stripe that deepens to dark brown on the entire vertical tubercle.

Pronotum variegated brown and yellow. Mesonotal praescutum with the restricted ground yellow, with four entire brown stripes, the intermediate pair narrowly separated by a ground vitta, posterior interspaces narrow and obscured; humeral region impressed, dark brown; a vague sublateral brown spot before suture, visible only in certain lights; scutum yellow, each lobe with two brown areas, the anterior one oval, about one-third the size of the posterior mark; scutellum and mediotergite yellow pollinose, with a narrow central brown stripe; pleurotergite yellow. Pleura olive yellow, patterned with brown, including areas on the anepisternum and a longitudinal line near the dorsal margin of the sternopleurite; dorsopleural membrane brown. Halteres with stem yellow, knob infuscated. Legs with the coxae olive yellow; trochanters yellow; femora black, with a broad brownish yellow ring before the narrower intensely black apex; tibiae and tarsi brownish black; claws with basal tooth. Wings with the prearcular and costal regions saturated yellow; disk variegated with pale brown and light yellow, the former more extensive; beyond the cord the yellow pattern appears as a short poststigmal band extending from costa into cell $R_5$; before cord the yellow pattern more extensive, subequal in amount to the brown, with two areas in cells *R* and *M* and others in the Anal cells, most restricted in cell *Cu*; veins brown, more yellowed in the brightened basal and costal parts. Venation: $R_{1+2}$ entire; petiole of cell $M_1$ longer than *m*; $M_{3+4}$ shorter than basal section of $M_{1+2}$.

Basal abdominal segments yellow, the tergites trivittate with dark brown, the stripes narrow; sixth and succeeding segments brownish black, hypopygium black. Male hypopygium distinctive; ninth tergite fused basally with the sternite, transverse, posterior border with a very broad U-shaped emargination, the lateral lobes relatively small, obtuse at tips; immediately beneath these a large flattened oval lobe or blade, its mesal edge blackened. Outer dististyle relatively long; inner style large, broad, beak small. Appendage of ninth sternite distinctive, broad at base, at near midlength narrowed into a long acute spine, surface of lobe with relatively few but very long and conspicuous pale setae. Aedeagus triangular in outline, without lateral shoulders.

Holotype, ♂, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher).

Other somewhat similar regional species include, besides *Tipula* (*Vestiplex*) *himalayensis* Brunetti, *T.* (*V.*) *distifurca* Alexander, *T.* (*V.*) *inæquidentata* Alexander, *T.* (*V.*) *nigroapicalis* Brunetti, *T.* (*V.*) *styligera* Alexander, *T.* (*V.*) *subtincta* Brunetti, and others more recently described by the writer. The present fly is quite distinct from all in the structure of the male hypopygium, particularly the tergite, inner dististyle and appendage of the ninth sternite. In its general appearance it most resembles *inæquidentata*.

**Tipula (Oreomyza) camillerii** new species

Size small (wing of male 10 mm.); general coloration brownish gray, praescutum with three slightly darker brown stripes; antennae with scape and pedicel yellow, first flagellar segment yellow, its tip blackened, remaining segments black; first flagellar segment elongate; legs black, femoral bases narrowly obscure yellow, claws of male simple; wings brown, variegated by yellow areas that form vague crossbands; $R_{1+2}$ atrophied, cell *1st* $M_2$ small, pentagonal; abdomen yellow basally, outer segments black; male hypopygium with the ventral part of the basistyle produced into a strong lobe that is tipped with spines; gonapophysis bearing a strong tooth on mesal edge; aedeagus trifid at apex.

MALE. Length about 8.5 mm.; wing 10 mm.; antenna about 3 mm.

Frontal prolongation of head yellowed above, darkened beneath; nasus short; palpi black throughout, terminal segment more than twice the length of the penultimate. Antennae of male of moderate length; scape and pedicel yellow, first flagellar segment yellow, the outer fourth blackened, remainder of organ black; first flagellar segment long-cylindrical, about equal to the succeeding two combined; flagellar segments beyond the first with the basal enlargement scarcely indicated, segments longer than their verticils, terminal segment very small. Head gray, more buffy in front; a capillary impressed darkened line extending from the low vertical tubercle backward; setigerous punctures of vertex conspicuous.

Pronotum brownish gray. Mesonotal praescutum brownish gray, with three slightly darker brown stripes, the median one more or less bordered and divided by dusky, the anterior end vaguely brightened; posterior sclerites of notum brownish gray, scutal lobes more or less darkened; scutellum and mediotergite with a central darker vitta; scutellum and postnotum with long pale setae, katapleurotergite vaguely more brightened. Pleura dark brownish gray; dorsopleural membrane yellow. Halteres with stem light yellow, knob infuscated. Legs with coxae and trochanters brownish yellow; remainder of legs black, femoral bases restrictedly obscure yellow; claws simple. Wings brown, variegated by yellow areas, as follows: At arculus, before and beyond origin of *Rs* in cell *R*, near outer end of cell *M* and as a crossband beyond the cord, extending from costa into cell $M_3$; a further brightening before midlength of cell *1st A*; cell *C* brown. *Sc* more yellowed; stigma small, brown, scarcely differentiated from the ground; veins brown, more yellowed in the subcostal field. Macrotrichia on veins beyond cord and on outer ends of *M*, *Cu* and most of *2nd A*, lacking on *Rs* and *1st A*. Venation: *Rs* long, nearly twice $R_{2+3}$, the latter forming an angle at the end of *Rs*; $R_{1+2}$ atrophied, vaguely persistent as a pale line; cell $M_1$ about twice its petiole; cell *1st* $M_2$ small, pentagonal, *m* being the shortest element; *m-cu* near outer end of $M_{3+4}$; cell $M_4$ deep, distal section of $Cu_1$ about twice *m-cu*.

Abdomen with basal five segments obscure yellow, the tergites narrowly darkened medially, the extreme posterior borders of the sternites narrowly suffused; outer segments, including hypopygium, black, the sixth sternite yellowed on basal part. Male hypopygium with the tergite narrowed

outwardly, posterior border with a broad U-shaped emargination, with a further tiny notch at the base, lobes broadly rounded. Region of ninth sternite produced mesad and caudad into a strong lobe that is tipped with six or seven strong spines arranged in a compact group. Outer dististyle broadest across outer end, apex obliquely truncated; inner style unusually broad, beak obtuse, lower beak still more obtuse, its margin corrugated, outer basal lobe obtuse, unmodified. Aedeagus relatively short and stout, terminating in three stout pale filaments; gonapophyses appearing as yellow blades, the tips acute, on mesal edge beyond midlength with a strong spine. Eight sternite with posterior border convexly rounded, without lobes or modified setae.

Holotype, alcoholic ♂, Kurseong, Darjeeling District, India, August 1957 (Aloysius Camilleri).

This interesting species is named in honor of the collector, Father Aloysius Camilleri, S.J., who has collected numerous interesting Diptera in the vicinity of Kurseong. The most similar regional ally is *Tipula* (*Oreomyza*) *gnoma* Alexander, of northeastern Burma, which differs especially in the structure of the antennae and male hypopygium. *T.* (*O.*) *striatipennis* Brunetti is more distantly related. All three species agree in the atrophy of vein $R_{1+2}$, thereby differing from the numerous other species of *Tipula* in the eastern Himalayan fauna.

**Dolichopeza (Nesopeza) longisetosa** new species

General coloration of head and thorax yellow; legs with tarsi and tips of tibiae white; wings weakly tinged with brown, stigma dark brown; male hypopygium with the posterior border of tergite conspicuously trilobed; ninth sternite with two pencils of very long setae; inner dististyle complex.

MALE. Length about 9 mm.; wing 9mm.; antenna about 3.5 mm.

Frontal prolongation of head obscure yellow; palpi dark brown. Antennae of male relatively long, as shown by the measurements, exceeding one-third the length of wing; scape and pedicel pale yellow, flagellum brownish black; verticils much shorter than the segments; in addition to the sparse verticils, segments with a dense very short pubescence. Head obscure yellow; vertical tubercle lacking.

Pronotum testaceous yellow. Mesonotal praescutum chiefly covered by three yellow stripes, the interspaces vaguely more obscured; scutal lobes yellow, the median region more obscured; scutellum and mediotergite brownish yellow, the latter clearer yellow behind. Pleura light yellow throughout. Halteres elongate, stem dusky, knob infuscated. Legs with the coxae and trochanters testaceous; femora obscure yellow basally, passing into brown outwardly; tibiae brown, the tips whitened; involving about the outer sixth to eighth; tarsi white. Wings weakly tinged with brown; stigma oval, dark brown; a vague paler brown seam at anterior cord; veins brown. Venation: *Rs* arcuated, longer than $R_{2+3}$; $R_{1+2}$ at-

rophied; $R_3$ long and straight, about one-half longer than $R_{2+3}$; medial forks relatively shallow, cell $M_1$ about one-half longer than its petiole; *m-cu* about three-fourths to four-fifths its length before the fork of *M;* cell *2nd A* narrow.

Basal abdominal segments light brown, the tergites more darkened outwardly, outer three or four segments dark brown. Male hypopygium with the posterior border of tergite conspicuously trilobed, including large lateral flattened scoops, their outer surface with blackened spicules, the most cephalic one a powerful spine; central tergal lobe blackened, base broad, apex gently convex, on either side with a shorter and paler obtuse hairy lobe. Ninth sternite on either side with a slender pencil of very long setae. Outer dististyle a long flattened blade, the outer setae longest; inner style with outer part of beak heavily blackened, connected with the pale lower or inner section by pale membrane, the latter, together with the extensive outer basal lobe, with abundant microscopic setulae.

Holotype, ♂, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher).

The most similar described regional species include *Dolichopeza* (*Nesopeza*) *lacteipes* Alexander and *D.* (*N.*) *orientalis* Brunetti, both differing evidently in the coloration of the body and appendages and in the structure of the male hypopygium. Attention is called to the exceedingly long hair pencils on the ninth sternite of the present fly.

**Limonia (Limonia) cnephosa** new species

Allied to *globithorax*; general coloration of body dark brown to brownish black; antennae with basal flagellar segments subglobular, outer ones with short glabrous necks; halteres and legs dark brown; wings relatively broad, very strongly blackened; cell *1st* $M_2$, nearly square, shorter than vein $M_4$; *m-cu* at or beyond the fork of *M*.

FEMALE. Length about 5 mm.; wing 5 mm.

Rostrum and palpi black. Antennae black throughout; flagellar segments subglobular, the outer ones more oval; segments with short glabrous necks; terminal segment subequal in length to the penultimate, its outer end pointed; verticils longer than the segments. Head dull brownish black.

Pronotal scutum brownish black, scutellum restrictedly obscure yellow. Mesonotum large, moderately gibbous, dark brown, posterior sclerites more yellowed, especially the scutellum. Pleura brown, sternopleurite paler. Halteres brownish black, base of stem restrictedly yellowed. Legs with coxae and trochanters brownish yellow; remainder of legs dark brown; claws long and slender, with spines at extreme base only. Wings relatively broad, very strongly blackened; veins brown. Venation: $Sc_1$ ending opposite midlength of *Rs*, $Sc_2$ at its tip; free tip of $Sc_2$ lying some distance before level of $R_2$; cell *1st* $M_2$ nearly square, slightly widened outwardly, shorter than vein $M_4$; *m-cu* subequal in length to distal section of $Cu_1$, placed at or shortly beyond the fork of *M*.

Abdomen dark brown; both the cerci and hypovalvae blackened at bases, outer ends more horn colored.

Holotype, ♀, Kathmandu Road, Mile 65.5, Nepal, June 24, 1957 (Coher).

Although it is quite distinct from all other regional members of the genus, the present fly is closely related to the Japanese *Limonia* (*Limonia*) *globulithorax* (Alexander), differing especially in slight details of the antennae and in the broader wings, with the venational details distinct. There seems to be no question of the validity of the present fly despite the present lack of the more distinctive male sex.

**Limonia (Limonia) decurvans** new species

Size small (wing of male about 6 mm.); general coloration of thorax obscure yellow; mouthparts very reduced to virtually lacking; basal flagellar segments subglobular, the outer ones elongate; wings strongly tinged with brown, virtually unpatterned; *Sc* and cell *1st* $M_2$ long; male hypopygium with two dististyles, rostral prolongation of ventral style with two spines on lower margin near base.

MALE. Length about 4.5–5 mm.; wing 5.5–6 mm.; antenna about 1 mm.

Rostrum and palpi very reduced to virtually lacking. Antennae with scape brown, the remainder black; basal flagellar segments subglobular, with short abrupt apical pedicels, beyond midlength of the organ the segments becoming progressively much longer; terminal segment nearly equal to the preceding two taken together; verticils shorter than the segments. Head blackened, paler on occipital region; eyes small; anterior vertex very broad, exceeding four times the diameter of scape.

Pronotum obscure yellow. Mesonotum obscure yellow, the central region of praescutum and the scutal lobes vaguely darker. Pleura obscure yellow. Halteres with stem dusky, knob infuscated. Legs with coxae and trochanters yellow; remainder of legs yellowish brown to brown, tarsi scarcely darker; claws long, with a strong basal spine and a capillary subappressed spine at near midlength. Wings strongly tinged with brown, virtually unpatterned, even the stigma scarcely apparent; veins light brown. Veins of outer half of wing with relatively short and inconspicuous macrotrichia. Venation: *Sc* long, $Sc_1$ ending about opposite or beyond three-fifths the length of *Rs*, in cases $Sc_2$ longer than $Sc_1$; free tip of $Sc_2$ and $R_2$ in transverse alignment; cell *1st* $M_2$ large, subequal to or longer than distal section of vein $M_{1+2}$; *m-cu* at or before fork of *M*, in cases to one-fourth its own length.

Abdominal tergites brown, sternites a trifle paler; hypopygium brownish yellow. Male hypopygium with the tergite transverse, the posterior border subtruncate to very feebly emarginate, cephalic margin more strongly convex; setae sparse, about eight or nine on either lobe, removed from the thickened margin; surface of tergal plate with abundant microscopic setulae. Basistyle with the ventromesal lobe stout, setae numerous, grouped

on apical half. Two dististyles, the outer one a pale straight rod, its outer half strongly narrowed; inner style small, its area about two-thirds that of the basistyle; rostral prolongation a compressed blade, its tip decurved; two rostral spines, large and pale, closely approximated on lower margin of prolongation near base, curved to the acute tips. Gonapophysis appearing as a pale blade, the apical lobe a direct posterior extension of the base of the style. Aedeagus broad, pale, tip bifid, slightly decurved; genital tubes approximated at midline.

Holotype ♂, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher). Paratopotypes, 3 ♂♂.

*Limonia* (*Limonia*) *decurvans* is readily told from all other regional members of the subgenus having unpatterned wings by the extremely reduced mouthparts and the structure of the male hypopygium, especially the presence of two dististyles and the decurved rostral spines of the ventral style.

**Limonia (Metalimnobia) hedone** new species

Size relatively large (wing of female 10 mm.); mesonotal praescutum brownish yellow with three brownish black stripes, the median one narrow, laterals broad, reaching the margin; posterior sclerites of notum black, mediotergite yellowed on posterior half; pleura black; knobs of halteres black; femora yellow, with two black rings, the more basal one broader, especially on middle and posterior legs, femoral tips broadly yellow; wings light yellow, heavily patterned with pale and darker brown, cell *M* along vein *Cu* with a series of about six dark brown spots; *m-cu* before fork of *M*; abdomen obscure yellow, lateral borders broadly blackened.

Female. Length about 8.5 mm.; wing 10 mm.

Rostrum and palpi black, the former relatively long. Antennae with the scape brownish yellow, pedicel light yellow, flagellum dark brown to brownish black; basal flagellar segments short-oval, outer ones elongate, terminal segment longest, about one-half longer than the penultimate; outer verticils very long. Head dull black, sparsely pruinose; anterior vertex narrow, about equal in width to two rows of ommatidia.

Pronotum brown. Mesonotal praescutum brownish yellow, with three brownish black stripes, the median one narrow, slightly widened behind, lateral stripes broad, reaching the outer border, the interspaces thus very wide; scutum narrowly silvery medially, the lobes extensively polished black; scutellum brownish black, parascutella obscure yellow; mediotergite brownish black on anterior half, sending a median point backward, the remainder obscure yellow or testaceous yellow. Pleura and pleurotergite brownish black, only the ventral sternopleurite paler. Halteres with stem yellow, knob black. Legs with the coxae brown; trochanters obscure yellow; femora yellow, each with two brownish black rings, the outer one narrow, subequal on all legs, less than the yellow apex, basal dark ring narrowest on fore legs, very broad on middle and hind pairs, including about one-third the length of the segment; tibiae yellow, tips very narrowly blackened;

tarsi black; claws of female with about five teeth, the outermost largest. Wings light yellow, heavily patterned with brown, costal border more saturated yellow; heaviest darkened areas include four in cell *R*, the third at origin of *Rs*, fourth at fork, confluent with the stigma; narrower dark brown areas at fork of *Sc*, cord and outer end of cell *1st* $M_2$; paler brown washes in outer radial field, at ends of longitudinal veins and as conspicuous washes in cells *Cu* and *1st A* and *2nd A*; cell *M* with more than the anterior half washed with pale brown, the clear posterior border adjoining vein *Cu* with about six small dark brown spots; veins brown, yellowed in the costal and arcular regions. Venation: $Sc_1$ ending beyond midlength of the sinuous *Rs*, $Sc_2$ near its tip; $Sc_2$ and $R_2$ subequal and in virtual transverse alignment; *r-m* lying just before the level of $R_2$; inner end of cell *1st* $M_2$ arcuated; *m-cu* about one-third to nearly one-half its length before the fork of *M*.

Abdomen obscure brownish yellow, darker laterally, sternites clearer yellow with broader lateral margins; outer segments with posterior borders more narrowly darkened. Ovipositor with cerci slender, gently upcurved to the acute tips; hypovalvae deep, blackened basally.

Holotype, ♀, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher).

The most similar regional species include *Limonia* (*Metalimnobia*) *biannulata* (Brunetti), *L.* (*M.*) *vajra* Alexander and *L.* (*M.*) *jactator* new species, all of which have patterned wings, differing among themselves chiefly in the coloration of the body and especially of the legs.

**Limonia (Metalimnobia) jactator** new species

Size medium (wing of female 8.5 mm.); mesonotal praescutum with the brownish yellow ground very restricted, heavily patterned with black; mediotergite chiefly obscure yellow; legs black, femora with base and subterminal ring yellow; wings pale yellow, patterned with brown, including three major areas in cell *R*; cell *1st* $M_2$ small, about one-half the distal section of vein $M_{1+2}$; *m-cu* more than three-fourths its length before the fork of *M*.

FEMALE. Length about 8 mm; wing 8.5 mm.

Rostrum and palpi black, the former relatively long, about one-third the remainder of head. Antennae with scape light brown, pedicel yellow, flagellum brownish black; flagellar segments short-oval, passing into more elongate-oval; verticils considerably longer than the segments. Head dull black, more pruinose on the anterior vertex, less so on the genae; anterior vertex narrow, about one-third the diameter of scape.

Pronotum brownish black, pretergites paler brown. Mesonotal praescutum with the restricted ground brownish yellow, the extensive pattern black, including a relatively narrow median stripe, slightly wider sublateral stripes and broad lateral margins, all these areas confluent at the suture; median region of scutum silvery, lobes brownish black; scutellum brownish black,

parascutella light yellow; mediotergite chiefly obscure yellow, weakly darkened on anterior half of central part; pleurotergite obscure yellow dorsally, the ventral part infuscated. Pleura chiefly brownish black, the ventral sclerites yellowed, including the ventral sternopleurite and meron; dorsopleural membrane dusky. Halteres with stem yellow, knob brown. Legs with coxae and trochanters yellow, fore coxae weakly darkened; remainder of legs black, femora with the basal fourth and a conspicuous subterminal ring light yellow, the latter narrower than the black tip; claws with three or four teeth, the outermost larger. Wings pale yellow, the costal and prearcular fields more saturated yellow; a heavy brown pattern, arranged as follows: Three major areas in cell *R*, including the origin and fork of *Rs*, the latter confluent with the stigma; cord and outer end of cell *1st* $M_2$ narrowly seamed; paler washes in base of cell *C* and at ends of longitudinal veins, very extensive in the Anal field; all marginal darkenings enclosing yellow submarginal spots; still paler brown washes in outer radial cells; veins brown. Venation: $Sc_1$ ending about opposite midlength of *Rs*, $Sc_2$ near its tip; cell *1st* $M_2$ unusually small, about one-half the distal section of vein $M_{1+2}$; *m-cu* more than three-fourths its length before the fork of *M*.

Abdomen obscure brownish yellow, sternites clearer yellow, pleural membrane dusky; genital segment and valves of ovipositor horn-yellow; cerci relatively small, gently upcurved.

Holotype, ♀, Simbhanjang Pass, Nepal, 8197 feet, June 24, 1957 (Coher).

As indicated under the account of *Limonia* (*Metalimnobia*) *hedone* new species, this latter fly and the present species are generally similar to one another and apparently closely allied, differing evidently in the pattern of the body and wings but especially of the legs.

**Limonia (Rhipidia) coheriana** new species

Belongs to the *morionella* group; general coloration polished black; size small (wing of male under 4 mm.); antennae of male bipectinate, the pedicels of the segments elongate; legs brownish black, outer tarsal segments paling to creamy white; wings pale grayish subhyaline, unpatterned; male hypopygium with the tergite narrowly transverse; rostral spines two, long, from a common elongate basal tubercle.

MALE. Length about 3.5 mm.; wing 3.8 mm.; antenna about 1.9 mm.

Rostrum and palpi black, the former of moderate length. Antennae of male black throughout, bipectinate, elongate, especially the pedicels of the flagellar segments which are approximately three-fourths as long as the longest branches; segments with the pedicels progressively shorter outwardly; apparently two simple terminal segments. Head black.

Thorax uniformly polished brownish black to black. Halteres with stem dirty white, knob infuscated. Legs with the coxae dark brown to brownish black; trochanters brown; remainder of legs brownish black, the outer tarsal segments paling to creamy white. Wings pale grayish subhyaline, without pattern, even the stigma lacking; veins pale brown. Venation: $Sc_1$ ending

opposite origin of *Rs*, $Sc_2$ far retracted; *Rs* only a little longer than the basal section of $R_{4+5}$; cell $M_2$ open by atrophy of *m*; *m-cu* about one-fifth its length beyond the fork of *M*; cell *2nd A* broad.

Abdomen brownish black. Male hypopygium with the tergite narrowly transverse, posterior border shallowly emarginate. Basistyle with the ventromesal lobe relatively small. Dorsal dististyle stout, gently curved, tip abruptly acute; ventral style subequal in area to the basistyle; rostral prolongation small, spines two, from a common tubercle. Gonapophysis with mesal-apical lobe relatively slender, the acute tip narrowly blackened.

Holotype, ♂, Jhawani, Nepal, March 19, 1957 (Coher).

I take unusual pleasure in naming this interesting fly for the collector, my long-time friend Dr. Edward I. Coher. The most similar regional species is *Limonia* (*Rhipidia*) *morionella* (Edwards), which is well-distinguished by the darkened stigma and structure of the antennae of the male. There are relatively numerous species of the group in the Oriental and Ethiopian regions, including Mauritius and Madagascar.

(*continued from page 222*)

Dr. Ramsey presented a series of kodachromes showing the vast numbers of pests intercepted at our ports-of-entry, and the methods of detection used.

The meeting adjourned at 10:00 P.M.

PETER FARB, *Secretary*

MEETING OF DECEMBER 3, 1957

President Treat called to order a regular meeting of the Society in Room 419 of the American Museum of Natural History at 8:00 P.M. Twenty-five members and ten guests were present.

Dr. Treat greeted the visitors. Mr. Bernard Heineman introduced his guest, Mr. Raymond Brush, an amateur lepidopterist, and Dr. James Mullen introduced Mr. Daniel J. Sullivan, S.J., a graduate student at the Fordham University Biological Laboratory. A belated announcement was made that Edwin Way Teale had been honored last June by Earlham College, his alma mater, with an honorary degree of Doctor of Letters.

Dr. Treat reported that the Executive Committee heard the report of Miss Alice Gray and Mr. Tony Roberts on the proposed Junior Entomological Society; concrete proposals on membership will be submitted at the next meeting.

The President asked Dr. Creighton, Chairman of the Nominating Committee which also consisted of Dr. Klots and Dr. Schneirla, to read the tentative slate of officers to be voted on at the Annual Meeting. Dr. Creighton stated that the Committee felt that the present officers have done an admirable job of conducting Society affairs, and they wished to return them to office. A few changes were suggested for the Publications Committee, however. Candidates nominated were: Dr. Treat, President; Dr. Mullen, Vice-President; Mr. Farb, Secretary; Mr. Bloch, Assist. Secy.; Mr. Huberman, Treasurer; Mrs. Vaurie, Asst. Treasurer.

For the Executive Committee: Mr. E. Irving Huntington, Mr. Bernard Heineman, Dr. Herbert Ruckes, Dr. Alexander B. Klots. For the Publications Committee: Mr. Frank Soraci, Editor, and Mr. Schwarz, Mr. Farb, Dr. Creighton.

Miss Gray nominated the following for membership in the Society: Miss Jeanette Berger and Mr. Peter Paul Watsky.

President Treat commented for the Executive Committee with reference to Mr. Bloch's proposal at the last meeting for an annual Society dinner. It was felt that there was not sufficient time in this year's program, but that the proposal should be taken under advisement in next year's programming.

Dr. Creighton introduced the speaker of the evening, Dr. Edward O. Wilson of Harvard University, a myrmecologist who recently completed a ten months' trip through the Australasian and Melanesian regions. Dr. Wilson explained that he had three purposes for his trip: to collect insects in areas where ants have not previously been collected or where collections are meager; to examine the available collections in the museums in this region; to study the zoogeography and distribution of the ant fauna there. Dr. Wilson commented that the ants found in New Guinea are more closely related to those of southeastern Asia than to those found in the islands to the east. The talk was illustrated with very interesting slides.

The meeting was adjourned at 10:00 P.M. after a brief discussion.

JAMES FORBES, *Secretary Pro. Tem.*

## MEETING OF JANUARY 7, 1958

The 66th Annual Meeting of the Society was called to order at 8:10 P.M. by President Treat in Room 419 of the American Museum of Natural History. Fourteen members and four guests were present.

Mr. Huberman reported on the periodic financial difficulties of the Society. Mr. Soraci reported on the progress in bringing publication of the Journal up to schedule.

The President announced that there has been a change in the list of candidates for office read to the Society at the previous meeting. Dr. Mullen found himself unable to accept the nomination for Vice-President, but Mr. Nicholas Schoumatoff has agreed to his name being proposed. No further nominations were made from the floor, and Dr. Clausen moved that the Secretary be empowered to cast one ballot for the entire slate. The motion was passed and the Secretary so voted.

Dr. Treat reported on a meeting of the Executive Committee at which plans for the Junior Entomological Society were further discussed. Under Miss Gray's direction, an organizational meeting of the young people will be held on February 8th to draw up plans which will then be submitted to the Society at the following meeting. Dr. Treat pointed out that Society members should be prepared to give their backing to the Junior group, and that annual charges to the Society would be about $20 for liability insurance. Miss Gray was warmly thanked for her efforts and authorized by the Society to proceed.

Miss Jeanette Berger and Mr. Paul Watsky were unanimously elected to membership. Dr. Vishniac announced that Dr. Treat has been elected a Fellow of the N. Y. Academy of Sciences.

Speaker of the evening was Dr. Morris Rockstein of NYU Medical School who addressed the Society on "Aging In Insects." Dr. Rockstein pointed out that there are many compelling reasons for using insects to study the physiology of aging: they are every bit as complex and interesting as higher forms; they are short-lived and the researcher can obtain many offspring (sometimes as many as 4000 bees a day from a single queen). Also, they are extremely inexpensive to keep in the laboratory: a colony of only 375 rats costs $7.50 a day, while for only a dollar he can have 50–100,000 flies.

Dr. Rockstein reported on his work in aging of adult houseflies and honeybees. Characteristics of old-age are seen in the skin, locomotion, senescence of nerves and brain. He located a key section of the brain which he used for comparison counts of cells in the tissue. A 35% loss of brain cells during life was found in some honeybees.

In a study of the possible enzymes concerned with aging in insects, Dr. Rockstein discovered the cholinesterase activity rose for the first 7 to 10 days and then remained on the same level for the rest of the life-span; this is a brain enzyme and seems concerned with the maturing of the brain rather than actual aging. He also studied the organic phosphate enzymes which trigger activity, and it was seen that they followed the same pattern as cholinesterase. However, alkaline phosphatase dropped during the first few days and was seen to be related to flight ability. Dr. Rockstein concluded that enzyme activity was not directly related to the problem under consideration.

While working on the resistance to DDT by houseflies in Korea, he observed that males have a shorter life-span than females. He experimented by keeping five cages of males and females, starting with about 150 flies in each cage. At the end of 21 days, no males survived while there were still many females alive. This was confirmed by mortality studies which showed that two-thirds of male houseflies died at the end of three weeks. When Dr. Rockstein included milk in the diet of the colonies, the females lived much longer than when they were just eating sugar and water. Not so with the males which had the same longevity in spite of the enriched diet. Thus, male houseflies are seen to have an immutable aging factor.

Dr. Rockstein gave statistics on longevity of various forms of life, based on sex differences. Examples were man, white rat, *Daphnia,* black-widow spider, mealworm and housefly—in all cases, the female of the species lived much longer.

Does the age at which the female lay eggs affect the longevity of the offspring? Dr. Rockstein's experiments to answer this question showed that 50% of female offspring from a four-day-old mother died. Mortality increased as age of the mother increased, until at parental age 27 days, 92% of the female offspring died. Yet, the male longevity remained about the same, regardless of age of the parent. Thus, again, we see that the male longevity factor is not affected. Dr. Rockstein is now attempting to learn

the part that the age of the male parent's sperm plays in these longevity figures.

After the interesting discussion period, the members adjourned to the foyer where refreshments were served. The meeting was adjourned at 10:10 P.M.

PETER FARB, *Secretary*

MEETING OF JANUARY 21, 1958

A regular meeting of the Society was held in room 419 of the American Museum of Natural History, President Treat presiding. Sixteen members and three guests were present.

Because the guest speaker presented two films, the President reversed the procedure of the meeting and delayed business matters until the conclusion of the speaker's talk.

Dr. George S. Tulloch of Brooklyn College spoke on "Schistosomiasis"—a disease caused by a deadly, parasitic worm. Dr. Tulloch stated that five percent of the world's population suffers from it, and evidence of it has been found in Egyptian mummies.

A Public Health Service film described the life-history of a form of *Schistosoma* that occurs in Central America and the Caribbean. Known as Manson's blood fluke, it lives inside the intestinal veins of humans, resulting in a lethal accumulation of fluids in the body. The intermediate host of the sporocysts is a tiny freshwater snail.

Schistosomes are widespread. Practically every gull in our area is loaded with a species of them, and "clam-diggers itch" is caused by a schistosome that parasitizes birds.

Dr. Tulloch showed his slides taken in China where, in certain areas, 95 percent of the population suffers from schistsomiasis. Discussion brought out the fact occurrence of the disease is even worse in Japan—100 percent in some places.

A Public Health Service training film on tapeworm, common in our area, was also shown.

At the conclusion of the talk, Dr. Treat announced the new members of the Society's standing committees. They are:

Auditing Committee: Sidney Hessel, Bernard Heineman, Herbert Schwarz. Program Committee: Nicholas Shoumatoff, Bernard Heineman. Field Committee: Dr. Alexander Klots, Nicholas Shoumatoff. Photographic Sales Committee: Dr. Klots, Dr. Lucy Clausen. Delegate to the N.Y. Academy of Sciences: Dr. Clausen.

Mr. Huberman reported that after payment of expenses on the current issue of the Journal, the treasury will be disturbingly low. Our financial plight is caused by annual income of $1800 and expenses of $2600. The President pointed out to the members that this indicates a probable rise in dues. He announced that his investigations revealed that the possibilities of income from Journal advertising were not good.

Mr. Soraci proposed Mr. William W. Metterhouse of 57 Sunset Boulevard, Hamilton Square, New Jersey, for membership.

The meeting adjourned at 9:45 P.M.

PETER FARB, *Secretary*

## MEETING OF FEBRUARY 4, 1958

The regular meeting of the Society was held in room 419 of the Museum of Natural History.

The meeting was opened at 8:15 P.M. by Dr. Treat. The minutes of the previous meeting were read by Dr. Treat, who also greeted the guests; Mr. Devlin of the New York Times, Mr. Watsky and Mr. Rex.

A report on the field trip was made by Mr. Shoumatoff. The trip is to be held near Bedford, N. Y. on grounds consisting of about 350 acres. On the grounds is a lake, a bog, trails, large fields, hemlock groves, lovely rock gorge, and a brook. The trip should be fruitful collecting for everyone who attends. The date for the trip is May 17.

Mr. William W. Metterhouse was elected to membership, unanimously.

The sympathy of the Society was extended to Mr. Dix on the loss of his father.

The speaker of the evening, Dr. Charles C. Doane was introduced by Dr. Treat. An abstract of his paper, "Some Relationships of Fungi and Bacteria to Vectors of Dutch Elm Disease," follows:

A study of some of the bacteria and fungi associated with the smaller European elm bark beetle, *Scolytus multistriatus* is in progress. Most of the work to date has been done on the microorganisms that are pathogenic to the beetles. A preliminary survey indicates that the most common pathogen is a fungus, *Beauveria bassiana* (Bals.) Vuill. Although the larvae, pupae and adults are about equal in susceptibility, the larval stage is most frequently attacked in nature.

Preliminary field observations indicated that the fungus infects only a low percentage of larvae (less than 10%) in trees in open sunny areas but may kill up to 98% of the larvae infesting trees in shaded or semi-shaded areas. This fungus may be a limiting factor for populations attempting to establish in shaded or semi-shaded areas.

While counts were made of larvae killed in shaded bark a number of confirmatory isolations were made by placing the mummified larvae on artificial media. Growth from these dead larvae was consistently a combination of *Beauveria* and a red-pigmenting bacteria, *Serratia* spp., probably *Serratia marcescens*. Isolation of these two microorganisms is of interest since a number of workers have found *Serratia* associated with *Beauveria* in infected silkworm cultures and have speculated on a possible symbiotic relationship between the two microorganisms. Further study will be made of this association.

Laboratory tests with *Serratia* in pure culture show that it will kill 70% to 80% of the larvae exposed to it on treated bark. The pathogenicity of the bacterium decreases considerably if it is grown for a prolonged period on artificial media.

Two new species of bacteria, *Aerobacter scolyti* and *Escherichia klebsiellaeformis* were reported pathogenic to bark beetles in France in 1955. Cultures of these bacteria were received from M. Pesson and the Institut Pasteur and their pathogenicity is being studied in laboratory cultures. Reports show that 100% kill of exposed larvae should occur within 72 hours but these bacteria have produced no more than 17% kill of beetle larvae in 5

days. The bacteria have apparently become attenuated from continued growth on artificial media and it is hoped that pathogenicity may be recovered by successive passage through larvae of the lesser European elm bark beetle. These bacteria have not been found to date in the beetle populations in Connecticut.

After Dr. Doane presented his paper an interesting discussion took place.

The meeting was adjourned at 9:55 P.M.

ROBERT G. BLOCH, *Assistant Secretary*

### MEETING OF FEBRUARY 18, 1958

A regular meeting of the Society was held at the American Museum of Natural History; President Treat presiding. The meeting was opened at 8:15 P.M.

Doctor Treat read the minutes of the February 4 meeting and same were accepted. He also welcomed the guests and announced that several speakers had been invited to participate in an anticipated Forum on Gypsy Moth Control. Also, Doctor Vishniac will speak March 21, at the New York Academy of Science.

William H. Loery, M.D., and Raymond Brush were proposed for membership.

The president introduced the speaker of the evening, Dr. James C. King. An abstract of his paper follows:

### WHAT HAS THE POPULATION GENETICIST TO OFFER THE ENTOMOLOGIST?

The entomologist is concerned with characters—morphological, physiological, behavioral. All taxonomy is based on them. There are differences in characters between species, between populations within species and between individuals within populations. These characters are all under genetic influence and the population geneticist is concerned with the processes which result in a given population having a given set of characters and which account for persistence or change in the set.

Genetically, characters may be produced by single genes or by polygenic complexes. The same characters may sometimes be produced by one, sometimes by the other; and where a polygenic complex is responsible, different complexes may produce the same result. Experimental selection for a polygenic character (resistance to DDT in *D. melanogaster*) has been shown to produce the same phenotypic result in two lines, identical in origin but independently selected. Genetic analysis of the two lines, however, disclosed that two very different gene complexes had been built up.

In any cross-breeding population which is reasonably near equilibrium the means and variances for any number of characters are definite and predictable. There is a modal phenotype: the great majority of individuals lie within definite phenotypic limits. This situation obtains because the gene pool of the population is an integrated system. The modal phenotype is produced by the random pairing of the chromosomes at fertilization. Artificially produced homozygotes deviate from the modal phenotype. Selection acts not on genes or chromosomes but on individuals—diploid sets of

chromosomes. Chromosomes which, when paired at random, give the nearest approach to the modal phenotype have the best chance of survival. The survival value of a chromosome (or gene) depends quite as much on the genetic milieu in which it is found as on its own makeup. The modal phenotype is produced by many interesting polygenic complexes; "switch" genes and extreme phenodeviants are exceptional phenomena.

Selection acts in a fluctuating and capricious manner. Hence no population ever achieves a perfectly integrated genetic system. Any change produced in a genetic system by selection sets in motion a complex readjustment involving compensatory changes leading toward a new integration. The whole process is continuously dynamic and kaleidoscopic. Since different local populations of the same species differ in such complex ways, the notion sometimes expressed that two species may differ in only one or a small number of genes is fantastic.

Doctor King recommended as bibliographical material The Cold Spring Harbor (1955) Symposium and the Journal of Evolution.

After many questions and a lively discussion period, the meeting was adjourned at 10:00 P.M.

ROMAN VISHNIAC, *Secretary pro tem.*

## MEETING OF MARCH 4, 1958

The regular meeting of the Society was called to order by President Treat at 8:05 P.M. in Room 419 of the American Museum of Natural History. Seventeen members and seventeen guests were present. Mrs. Vaurie was appointed Secretary *pro tempore*. Minutes of the meeting of 18 February were read and approved. The President read an excerpt from a letter from Mr. Soraci, Editor of the Society's Journal, stating that all copy for the 1957 volume was in the hands of the printer, and that material is accumulating for the first issue of 1958. There were no reports of other officers.

In the absence of Mr. Hessel, the report of the Auditing Committee for 1957 was read by Mr. Heineman, who had served with Mr. Hessel and Mr. Schwarz. The report was accepted by unanimous vote of the Society.

William H. Loery, M.D., and Raymond Brush were unanimously elected to membership. There were no proposals for new membership. Miss Alice Gray reported that the Junior Entomological Society, under her direction, has requested the senior Society to supply speakers on the following subjects: (1) How to tackle a taxonomic research problem; (2) Insect photography; (3) Tropical butterflies; (4) The ecology of the pine barrens; (5) Fossil insects. Mr. Shoumatoff agreed to speak on topics 1 and 3, Dr. Elsie Klots on topic 5, Dr. Clausen on 2, and Dr. A. B. Klots on 4.

The paper of the evening was given by Mary H. Loveless, M.D., of New York Hospital. It was entitled *The hazard of insect stings.* An abstract follows:

Despite the importance to man of plant pollination and honey, bees and especially wasps at times comprise a serious hazard when a state of allergy toward venom exists in the victim of stinging. The reaction to the sting is in this instance not restricted to the usual hivelike redness and

swelling that occurs at the site of inoculation but involves the whole body with such responses as a rash, acute drop in bloodpressure followed by unconsciousness, suffocation due to swellings in the airways, and other serious disturbances. All these reactions are dependent on the presence of allergic antibodies which combine immediately with any venom in their vicinity to give rise to acute inflammation.

There is, fortunately, a means of protection. It consists of a series of cautious injections of the patient each spring with venom which has been taken from a healthy, lively insect of the type that has induced his allergic antibodies. These graduated injections can, we find, be completed during $2\frac{1}{2}$ hours without untoward reactions. They cause the body to build up antibodies of another variety, the so-called blocking antibodies. The latter combine with any venom the patient may receive through the sting of an insect in the field. The venom is promptly "neutralized" and inactivated by this combination and fortunately the antibody-venom complex is nonirritating to the host. Furthermore the blocking antibody has a greater avidity for the venom than has the allergic antibody in the body. The result of this competition between the two types of antibody is that only the blocking type unites with the venom. Thus, the allergic reaction is forestalled and prevented. In short, the patient tolerates the venom which had formerly produced a serious allergic reaction in him. He is immune because of his possession of the blocking, or protective, antibodies.

It is unfortunate that the blocking antibody is produced only for a period of some six months after the course of venom injections. Thus the patient must be immunized each year prior to the time of appearance of the wasps in summer. The allergic antibody, on the other hand, seems to be formed for years once they have been made by the body.

During the past decade, while we were working out the method of immunization with venom, we have introduced the planned stingtest to discover whether the treated patient could indeed tolerate the sting of a lively insect which had formerly caused him to become seriously ill. We have found that all patients, with the possible exception of one man who had also a blood disorder, can take the sting of from one to four insects without any adverse affect. It is, of course, necessary to have all equipment at hand for immediate use should allergic reactions ever be encountered during these challenges. They have clearly established the safety and efficacy of venom-immunization, and thus man has now a means of defense against this unusual hazard.

A prolonged and very lively discussion followed the presentation of Dr. Loveless, and continued for some time after formal adjournment at 9:45 P.M.

MRS. PATRICIA VAURIE, *Secretary pro tem.*

## MEETING OF MARCH 18, 1958

A regular meeting of the Society was called to order by the President, A. E. Treat, at 8:10 P.M. in Room 419 of the American Museum of Natural History. Thirteen members and five guests were present. The president read the minutes of the previous meeting which were approved as read. Announcements were made of the forthcoming meeting of the New York Acad-

emy of Science at which Dr. Vishniac will speak; of the coming N. Y. A. S. Conference on Axenic Culture of Invertebrate Metazoa; of a recent publication on *Papilio nise* by Trustees Klots and Heineman; and of a new journal *Entomologia* scheduled for early appearance in the Netherlands.

A meeting of the Interim Editorial Board (Executive and Publications Committees) held on 17 March at the home of Mr. Heineman was briefly reported by the President. Miss Gray reported upon the progress of the newly formed Junior Division of the New York Entomological Society. Organization of this group, with Miss Alice Gray as Senior Advisor, was recently completed, with the following officers: President, Tony Roberts; Vice President, A. Clifton Hooks; Corresponding Secretary, Maureen O'Connor; Recording Secretary, Paul Watsky; Treasurer, Joel Hallam. Membership is up to the present limit of 15, with a considerable waiting list. Dues of $1.50 payable in two installments in April and October have been voted. Meetings are scheduled for 10:30 A.M. to 1:00 P.M. on the first and third Saturdays of each month, the year around. Liability insurance covering the group's activities has been purchased through the generosity of Mr. Bernard Heineman. Several successful and well-attended meetings have already been held, at one of which Dr. Klots spoke on the Ecology of the Pine Barrens. Joint activities with the senior Society are contemplated.

There being no further business, the President introduced the speaker of the evening, Mr. A. L. Taylor, Head Nematologist of the Crops Production Research Division of the Agricultural Research Service, United States Department of Agriculture. Mr. Taylor spoke on *Recent Research in Nematology*. An abstract follows:

The word nematology as used in the title refers to the study of the plant parasitic and soil nematodes, with occasional contacts with the insect parasites, marine and freshwater nematodes. This includes some 5,000 known species, probably only a fraction of those existing. Plant parasitic and soil nematodes occur in hundreds of millions per acre in all soils where anything can grow and some are important economic parasites of crop and ornamental plants. In general, these nematodes are less than a millimeter long and only about 20 microns wide, too small to be seen easily without a microscope, but large enough to be seen easily when separated from the soil. These tiny bodies have a complete digestive system, a nervous system, reproductive organs, muscles and an excretory system. Reproduction is by eggs and the nematode passes through 4 larval stages, separated by moults, before reaching the adult stage. Plant parasitic nematodes feed on living plants, mostly on the roots, but sometimes also on the above ground parts, and if food is available, may develop to adult stage in a few weeks. If food is not available, as during the winter in cultivated fields, or conditions are unfavorable some species remain indefinitely in the second larval stage. Larvae of the golden nematode of potatoes may remain alive in cysts in soil for as long as ten years, and larvae of the wheat nematode have been found alive after 28 years of storage in dried galls.

Since nematodes are somewhat specialized parasites, able to reproduce on certain plants but not on others, they can be controlled by crop rotation; perhaps one of the chief advantages of crop rotation is nematode control. Another method is trap cropping, the modern improvement of this old

method being the use of trap plants which the nematodes can invade, but in which it cannot complete its development and reproduce. In the past ten years, most progress has been made in the popularization of nematocides which are used for killing nematodes in the soil before the crop is planted. These are mostly fumigants which are applied by injection into the soil and are being used with notable success in increasing crop yields by pineapple growers in Hawaii, tobacco growers in the southern states and vegetable growers in many parts of the country.

Mr. Taylor's remarks excited much interest and many questions. The meeting was adjourned at 10:10 P.M.

ASHER E. TREAT, *Secretary pro tem.*

## MEETING OF APRIL 1, 1958

A regular meeting of the Society was held at the American Museum of Natural History. The President called the meeting to order at 8:10 P.M. Twelve members and eight guests were present.

It was announced that the *Zoological Record* of London has appealed for a contribution from the Society. The membership felt that the Society was not presently in a financial position to give any donations; however, several members have given individual donations and a few members offered to make up the difference between these and $100. A contribution will thus be mailed in the name of the Society.

Mr. Soraci reported on the publication of the *Journal* and appealed for more filler material. Mr. Shoumatoff reported on plans for the Field Trip on May 17th.

Mrs. Edward R. Fusselman, 6 Robert Court, West Orange, New Jersey was proposed for membership.

Dr. Daniel Ludwig of Fordham University spoke on "Metabolism In The Insect Egg." He described the changes in carbohydrate, fat, various nitrogen and phosphorus fractions, activity of the succin-oxidase system, and the rate of $O_2$ consumption which occur during the embryonic development of the Japanese beetle. This development requires eight days at 30 degrees C. Reducing substances increase during early embryogenesis and then decrease on the fourth day. Oxidation of glycogen furnishes the main source of energy during the first four days, followed by the utilization of fat. During the first four days there are pronounced shifts in nitrogen and phosphorus from fraction C (water soluble, precipitated by tungstic acid or trichloracetic acid) to other fractions which include lipid, acid soluble and the insoluble fractions.

Similar changes occur to a more limited extent during the latter part of the embryonic period. The activities of cytochrome oxidase and succinic dehydrogenase decrease rapidly during the first four days, associated with the imbibation of water and an increase in weight. During the latter part of the embryonic period the activities of these enzymes increase rapidly although weight remains constant. These observations suggest a change in the mechanism of embryogenesis at the fifth day. A study of embryonic development of carefully timed eggs has shown that blastokinesis occurs between the fourth and fifth days. Prior to this process, organ formation occurs; and following it, differentiation predominates. The energy for blasto-

kinesis may be obtained from the oxidation of reducing compounds.

The meeting adjourned at 9:30 P.M.

ROBERT G. BLOCH, *Assistant Secretary*

## MEETING OF APRIL 15, 1958

President Treat called a regular meeting to order at 8:05 P.M. in room 419 of the American Museum of Natural History. Twenty-seven members and 19 guests were present.

The President announced that Drs. Klots and Dos Passos were planning to attend the International Congress of Entomology; a motion was passed electing them official delegates of the Society to the Congress. The Society voted to dispense with the regular order of business to allow more time for the program.

The program was a forum on the question: Is aerial application of insecticides a desirable means of controlling the gypsy moth? The moderator, Mr. A. A. Miller, an attorney, introduced the three speakers: Frank A. Soraci, Director of the Division of Plant Industry, New Jersey Department of Agriculture; Dr. Robert Cushman Murphy, Curator Emeritus of Birds, American Museum of Natural History; Dr. John L. George, Associate Curator of Mammals, New York Zoological Society.

Mr. Soraci described the life-history of the moth and the early attempts to battle the pest in Massachusetts. To date, about $100 million of public funds has been spent only to control the moth. Yet, the worst defoliation in history took place in 1953 and the insect continues to spread. As a result of this breakthrough of the moth, an additional 100 million acres of important hardwood forests are threatened. We now have a material, DDT, and an aerial method of application which give hope of eradication, said Mr. Soraci. The current eradication program of the states and U.S. Department of Agriculture got underway to a limited extent in 1956, and the large-scale program began in 1957 with the spraying of three million acres. These are the results: an isolated outbreak of the moth around Lansing, Michigan, has been eradicated; there have been no recoveries of moths in areas sprayed in Pennsylvania and New Jersey; excellent results have been achieved in New York State, except on Long Island where some live moths have been trapped. The gypsy moth campaign, stated Mr. Soraci, is in the public interest, and eradication is being achieved. No damage to humans, plants, fish, bees, animal life has occurred that would indicate discontinuance of the program.

Dr. Murphy stated that control of some insect pests was needed. The best example, he feels, is the campaign against the Japanese beetle in the 1930's. But the current gypsy moth program is in sad contrast. And the USDA fire ant program in the South he regards as being even more flagrant because: no research was done on the ant between 1953 and 1957, few investigations were made of possible parasites, there is no knowing whether the current outbreak is a cyclic peak. Dr. Murphy doubts that it is possible to eradicate any insect by chemical means, and states that no example of an insect so eradicated can be found. Between 1949 and 1953, New England was sprayed from the air to control gypsy moth; yet the worst outbreak in history took place in 1953. Dr. Murphy objects to trespass by the federal government and states upon private property, and he objects to irresponsible statements

on the program of USDA. The situation on Long Island is that there have been 37 centers of gypsy moth outbreak of long standing and that in spite of the spraying, the moth will still be there in future years. And, because of insect resistance to pesticides, the dosage will continually have to be increased.

Mr. Soraci, in rebuttal, questioned the success of the Japanese beetle campaign since the pest is still doing much damage in ever increasing areas. As for the possibilities of eradicating an insect by chemical means, Mr. Soraci stated that it now appears eradication of the Medfly in Florida has been achieved. This is the most recent example, but there are others. The aerial spraying with DDT in New England in 1949 was not aimed at eradication, stated Mr. Soraci, but was a local effort to alleviate defoliation. Regarding Dr. Murphy's statement about the gypsy moth program being a trespass on private property, Mr. Soraci said that at least in New Jersey, the state has right of entry to alleviate a public nuisance. DDT, Mr. Soraci concluded, has been a boon to mankind in controlling many human diseases and insect pests.

Dr. Murphy described the effects of the 1957 spray program on Long Island. He believes it wiped out the balance of nature. Some areas were sprayed as many as 15 times. There were dangerous concentrations of DDT in milk. An analysis of peas from the sprayed area showed they contained 14–20 parts per million of DDT, thus making them unfit for human consumption. He had tissues and livers from dead birds analyzed and found they contained high proportions of DDT.

Dr. George stated that his position was nearly midway between the two previous speakers. He said that the gypsy moth is an exotic, introduced species that will at first have cyclic populations, eventually hit a balance and decline in numbers. Dr. George said that not all trees are susceptible to moth attacks and that the hardwoods can be defoliated for a number of years without dying. He has hopes for control of the moth if more work were done in biological control; for example, there is a disease attacking the moths that makes rearing them in the laboratories very difficult. Dr. George's recommendations for a good gypsy moth program would be: no mass spraying but rather spot spraying in outbreak areas. Also, more biological control research should be undertaken.

In discussions from the floor, it was brought out by Dr. Klots that the moth disappeared from Putnam, Connecticut, around 1940 without any chemical control being used; he believes that ecological factors will eventually take over to reduce populations. In response to a question, Mr. Soraci gave figures on the economy and efficiency of the current spray program: to eradicate the moth (requiring spray of about 23,000 acres) in New Jersey in the 1920's, took 11 years and cost 2½ million dollars. Eleven hundred man years of labor were expended in the whole control operation. Today, a single airplane in only four hours, at a cost of less than $23,000, can spray the same acreage with the same results.

Dr. George said that the effect of sub-lethal doses of pesticides should be investigated for their cumulative effect. On the question of biological control, it was stated from the floor that for two decades USDA and the states spent $2 million to release well over 100 million parasites and predators;

also, the polyhedrosis virus has been known for 50 years, yet gives biological control of the moths only at high population levels.

The meeting was adjourned at 10:05 P.M.

PETER FARB, *Secretary*

## MEETING OF MAY 6, 1958

President Treat called the regular meeting to order at 8:10 P.M. at the Museum of Natural History. Twenty-five members and seven guests were present. Because of the length of the minutes on the gypsy-moth forum of April 15, it was voted to dispense with their reading.

Dr. Treat announced that there had been much favorable response to the gypsy-moth forum; he also stated that contributions to the *Zoological Record* fund exceeded expectations and a check has been mailed in behalf of the Society.

Mr. Shoumatoff reported that Drs. Klots and Teale will participate in the traditional Members' Symposium on May 20th. He also gave the highlights of some of next season's programs.

Mr. Soraci reported that he wished to publish an up-to-date membership list in the first issue of the Journal for 1958, but that he does not have the specialties of all the members. The time necessary to obtain them would delay publication of the list. A motion was made and passed to dispense with the specialties.

Mr. Schoumatoff reported on the plans for the Field Trip, and attempted to arrange transportation for members.

Miss Alice Gray told the Society that the Junior Division has grown to approximately 20 members and that Dr. Klots gave a talk on fossil insects which was enthusiastically received. The Society passed a motion to pay the transportation expenses of Junior members who could not otherwise afford to go on the Field Trip.

Mrs. Edward R. Fusselman of 6 Robert Court, West Orange, N.J., was elected to membership.

The speaker of the evening, Dr. Thomas Eisner of Cornell University, gave an illustrated talk on "Food Economy in Ant Societies." Dr. Eisner first discussed the food economy of the Australian honey ants. Selected workers in these colonies become repletes and a special compartment of their digestive tract becomes gorged with liquid food. The repletes are little more than living storage casks to maintain the supply of food during times of shortage.

The transmission of food by regurgitation is extremely rapid. Dr. Eisner developed an experiment with Dr. E. O. Wilson of Harvard to determine to what extent food transmission can be figured quantitatively. They first removed a worker from a colony, and allowed her to feed on radioactive honey. The worker was then returned to the nest and time was allowed for the honey to be passed around the colony by regurgitation. The radioactivity was then measured. One of the nests experimented with became uniformly radioactive within only 24 hours; seventy percent of another nest became radioactive in three hours.

Dr. Eisner illustrated the digestive tract of the ants, emphasizing the crop which is the "social" stomach and the mid-gut which is the gut proper. Liq-

uid food is first stored in the crop which becomes swollen, and tremendous pressure is built up. What prevents the liquid from leaking out of the crop into the mid-gut? Dr. Eisner stated that there is an intermediate structure between the crop and the mid-gut—the proventriculus—which acts like a valve. This organ is different in various genera of ants, while it is monotonously the same in other Hymenoptera. Dr. Eisner traced the development of this organ, from the primitive organ of the Australian Bull Ant up to the higher ants, illustrating the many variations in structure. Since feeding by regurgitation is important in the social life of ants, Dr. Eisner stated that the incredible complexity of this one small organ has influenced the evolution of ant societies. Because of the proventriculus, when there is little food available every ant in the colony still has a share of that little; when lots of food is available, each ant equally has a good supply in its crop.

Following a lengthy discussion period, the meeting was adjourned at 9:45 P.M.

PETER FARB, *Secretary*

MEETING OF MAY 20, 1958

A regular meeting of the Society was held at the American Museum of Natural History. President Treat called the meeting to order at 8:05 P.M. Eighteen members and five guests were present.

Mr. Soraci announced delivery of a file of Society archives to the President. He also reported that the page proofs of the last issue of the Journal for 1957 were on hand and indexed, and that all material for the 1958 volume had been received.

Chairman Klots of the Field Trip Committee reported on the highly successful visit of the Society to the Butler and Westmoreland Sanctuaries in Bedford, N.Y. on May 17th. About 40 members and guests attended, including junior entomologists.

Miss Gray reported that the Junior Entomological Society consists of 17 members and 12 interested persons, of whom 14 attended the field trip. Because Miss Gray will be returning to California next fall to continue her doctoral studies, the question of replacing her as sponsor of the Junior Society was discussed. A motion was made and passed expressing appreciation to Miss Gray for her work in guiding and building up the Junior Society.

The program of the evening was the traditional Members' Symposium. The first contributor was Dr. A. B. Klots, who showed a series of slides of excellent color photographs he had made in New Mexico, Connecticut and Pelham, N.Y., illustrating various orders of insects at close range. They included Culex mosquitos, the white-faced hornet and a group picture of a bee, crab spider and two ambush bugs in a chain of predation and reproduction.

Dr. Teale showed a group of colored slides recording his field explorations from the St. Lawrence to the Rio Grande and including both entomological and ornithological topics.

Following a discussion by each of the members present on his plans for the summer, which covered a wide range of geographical and entomological interests, the meeting adjourned at 9:55 P.M.

NICHOLAS SHOUMATOFF, *Secretary pro tem.*